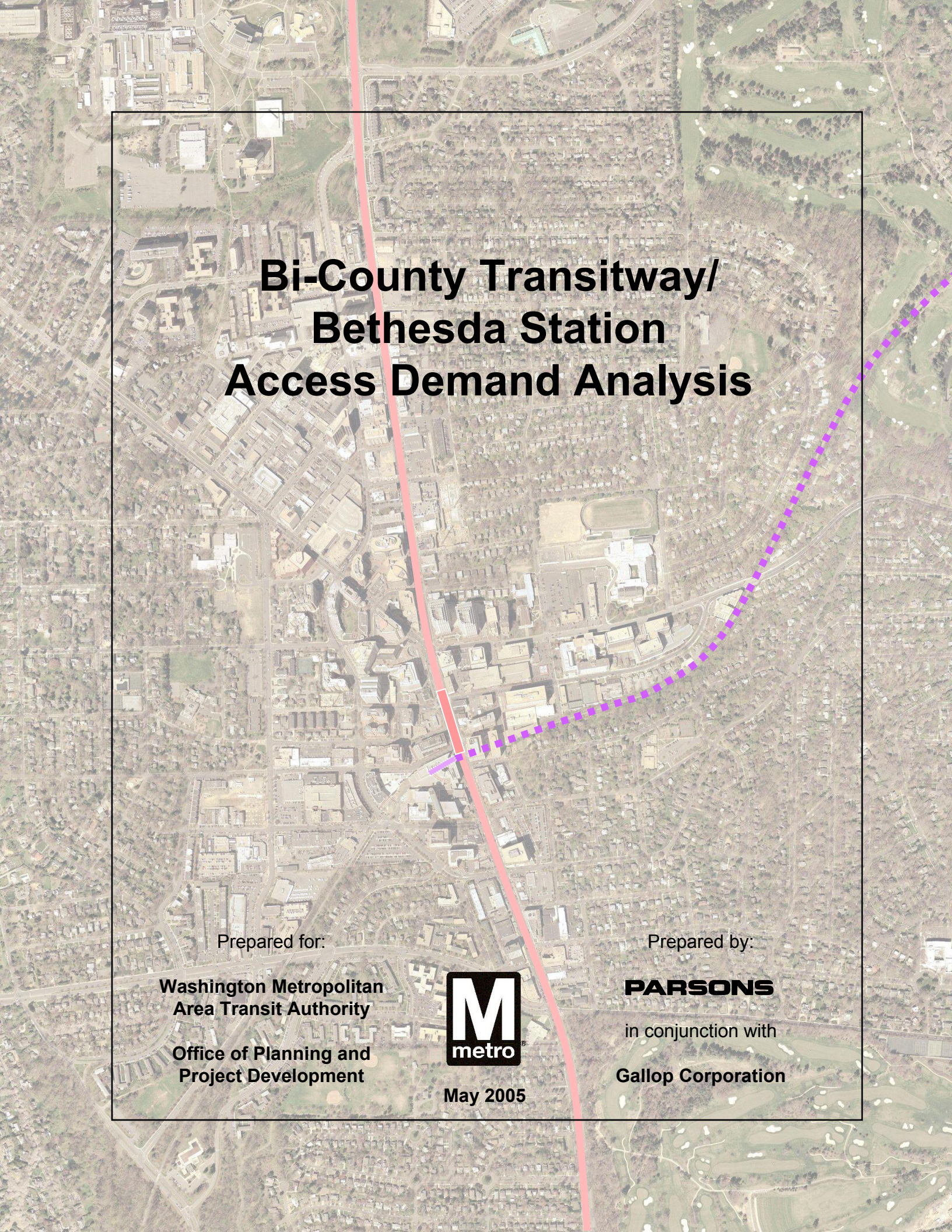

Bi-County Transitway/ Bethesda Station Access Demand Analysis

Prepared for:

Washington Metropolitan Area Transit Authority

Office of Planning and Project Development

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EXECUTIVE SUMMARY

The addition of a new south entrance to the Bethesda Metrorail Station offers an opportunity to expand the accessibility of the station to the surrounding area. Likewise, the proposed Bi-County Transitway offers the prospect of improved transit connections between Bethesda and Silver Spring, College Park, and New Carrollton. This study determines the effects of a south entrance and the Bi-County Transitway on Bethesda-based transit ridership and on the infrastructure of the Bethesda Station.

Three options were considered in this study for the year 2030, as follows:

- Option 1: No-build scenario, where existing conditions remain unchanged
- Option 2: South Entrance scenario, where no new transitway is assumed, but the south entrance is assumed to provide access to the Metrorail platform
- Option 3: Bi-County Transitway scenario, where the transitway is assumed to be in place along with the new south entrance

Land Use

A comprehensive review of land use in the Bethesda Station area was conducted based on data from the Metropolitan Washington Council of Governments (MWCOG) and the Maryland-National Capital Park and Planning Commission (M-NCPPC). The forecast calls for a 37 percent increase in Bethesda-area jobs and a 55 percent increase in Bethesda-area households by 2030.

A new south entrance to the Bethesda Station would help serve the increased population and employment by reducing walking distances to and from the station. By 2030, the south entrance would increase the number of jobs within ¼ mile of a Metrorail Station entrance by 11 percent, and would increase the number of households within the same radius by 27 percent.

Existing Ridership

The Bethesda station currently handles about 9,500 Metrorail boardings per day, with a similar number of alightings; the station is in the top fourth of all Metrorail stations when ranked by ridership. Boardings and alighting volumes are nearly equal during much of the day, demonstrating that the Bethesda area attracts Metrorail passengers nearly equally from both residential and office land uses.

Walking is by far the most common access mode for passengers arriving at the Bethesda station. Over 70 percent of daily passengers walk to the station, increasing to nearly 90 percent during the afternoon peak period. About 10 percent of daily passengers arrive by bus, while 9 percent drive and park.

Future Ridership

Version 2.1 D of the MWCOG travel forecasting model was used to evaluate future ridership on Metrorail and the Bi-County Transitway in the year 2030, and the Metrorail Development-Related Ridership Survey was used to evaluate the ability of the south entrance to induce new ridership. Ridership results are presented in Table 1.

Table 1: Adjusted Ridership Summary, 2030

AM Peak Period		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	5,100	3,100	0	0	0	0	**5,100**	**3,100**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**5,100**	**3,100**	**0**	**0**	**0**	**0**	5,100	3,100
Option 2: South Entrance without Bi-County	North	3,600	2,200	0	0	0	0	**3,600**	**2,200**
	South	1,600	1,000	0	0	0	0	**1,600**	**1,000**
	Total	**5,200**	**3,200**	**0**	**0**	**0**	**0**	5,200	3,200
Option 3: South Entrance with Bi-County	North	3,500	1,900	0	0	0	0	**3,500**	**1,900**
	South	1,500	900	300	1,400	400	800	**1,900**	**2,200**
	Total	**5,000**	**2,800**	**300**	**1,400**	**400**	**800**	5,300	4,200

PM Peak Period		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	3,100	5,000	0	0	0	0	**3,100**	**5,000**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**3,100**	**5,000**	**0**	**0**	**0**	**0**	3,100	5,000
Option 2: South Entrance without Bi-County	North	2,200	3,500	0	0	0	0	**2,200**	**3,500**
	South	1,000	1,600	0	0	0	0	**1,000**	**1,600**
	Total	**3,200**	**5,100**	**0**	**0**	**0**	**0**	3,200	5,100
Option 3: South Entrance with Bi-County	North	2,000	3,300	0	0	0	0	**2,000**	**3,300**
	South	900	1,500	1,400	300	800	300	**2,300**	**1,800**
	Total	**2,900**	**4,800**	**1,400**	**300**	**800**	**300**	4,300	5,100

Daily		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	13,000	13,100	0	0	0	0	**13,000**	**13,100**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**13,000**	**13,100**	**0**	**0**	**0**	**0**	13,000	13,100
Option 2: South Entrance without Bi-County	North	8,500	8,400	0	0	0	0	**8,500**	**8,400**
	South	4,700	5,100	0	0	0	0	**4,700**	**5,100**
	Total	**13,300**	**13,500**	**0**	**0**	**0**	**0**	13,300	13,500
Option 3: South Entrance with Bi-County	North	7,900	7,800	0	0	0	0	**7,900**	**7,800**
	South	4,400	4,800	2,400	3,200	2,000	2,000	**6,700**	**8,000**
	Total	**12,200**	**12,600**	**2,400**	**3,200**	**2,000**	**2,000**	14,600	15,800

Note: Figures are rounded to the nearest 100 riders, which may affect sums.

The ridership forecast shows the following notable trends:

- In Option 1, boardings and alightings would increase to about 13,000 per day by 2030, an increase of about 35 percent over existing conditions.
- The south entrance would induce a 3.2 percent increase in pedestrian-based Metrorail ridership from residential areas and a 7.5 percent increase in pedestrian-based ridership from commercial areas.
- The south entrance would capture about 37 percent of the station's rail access trips in Option 2 and about 48 percent of rail access trips in Option 3.
- The addition of the Bi-County Transitway would increase total Bethesda-based rail ridership by about 13 percent, although Metrorail ridership would decrease slightly.

Capacity Constraints

An evaluation of the Bethesda Station's infrastructure showed the following:

- In the No-build scenario, the Bethesda station's only capacity shortfall would be the vertical passenger circulation between platform and mezzanine. If a south entrance were constructed, the existing north entrance would operate below capacity.
- The elevator-based south entrance would require three elevator cabs in Option 2 and five cabs in Option 3.

A summary of the station's infrastructure requirements is presented in Table 2.

Table 2: Summary of Bethesda Station Infrastructure Requirements

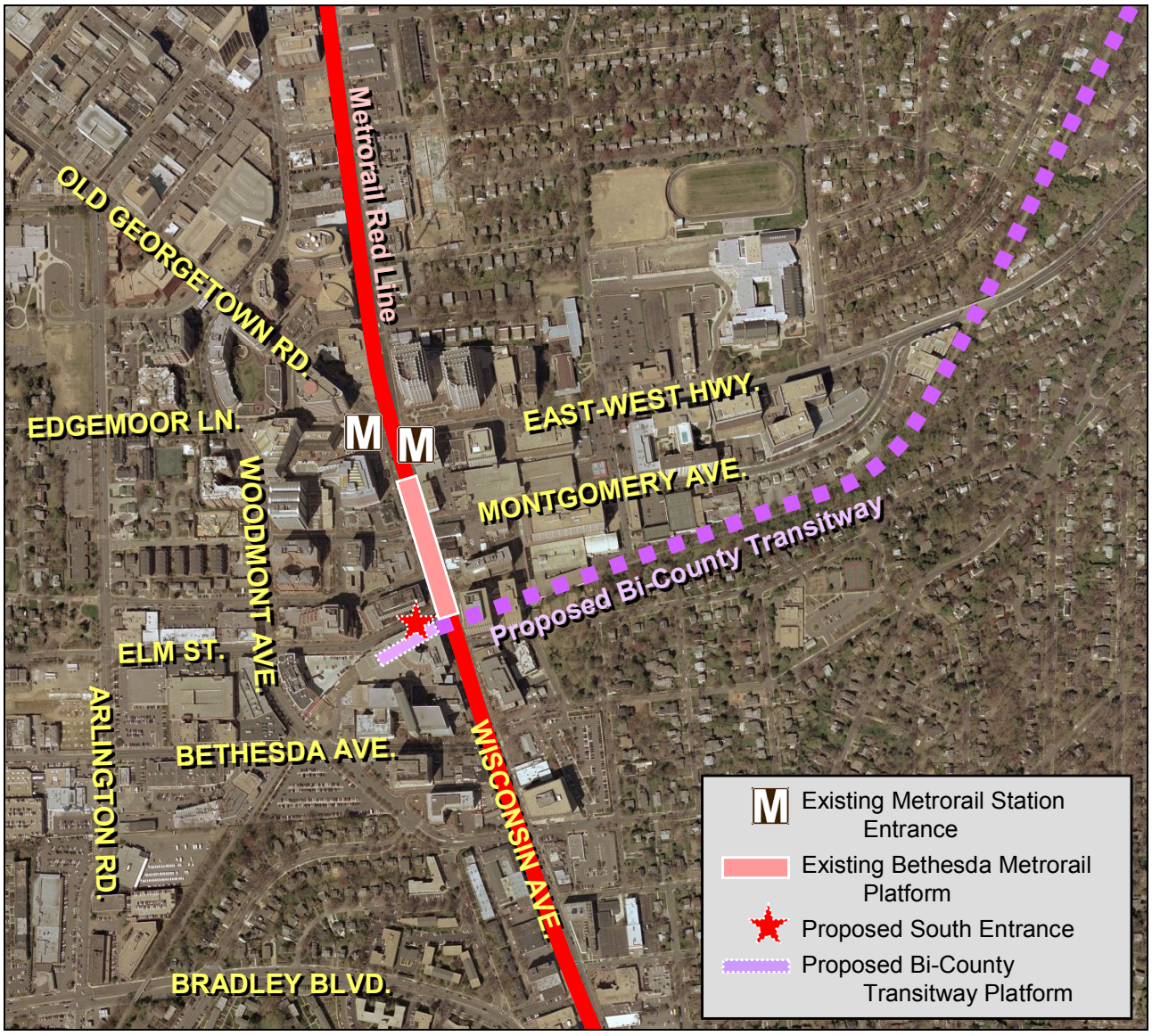
Infrastructure Element			*North Entrance*				*South Entrance*	
			Existing	*Option 1*	*Option 2*	*Option 3*	*Option 2*	*Option 3*
Vertical Circulation	Street to mezzanine	Escalators	3	3	2	2	0	0
		Elevators*	1	2	2	2	3**	5**
		Stairs	0	0	0	0	1	1
	Mezzanine to platform	Escalators	2	2	2	2	1	1
		Elevators*	1	2	2	2	2	2
		Stairs	0	1	0	0	1	1
Farecard Vendors			7	7	5	5	2	3
Fare Gate Aisles		Standard	7	5	3	3	2	3
		ADA	1	2	2	2	2	2
		Spare	0	1	1	1	1	1
		Total	8	8	6	6	5	6

* A minimum of two elevators is recommended for redundancy.
** One additional elevator should be considered for redundancy.

INTRODUCTION

The Bethesda Metrorail Station is located in southern Montgomery County, Maryland, and serves the surrounding mix of office, retail, entertainment and residential development. The station is on Metrorail's Red Line, which operates between Shady Grove and Glenmont via downtown Washington, D.C. The Bethesda Station opened in 1984. An aerial photograph of the area is presented in Figure 1.

Figure 1: Bethesda Vicinity



In the Bethesda vicinity, the Red Line runs in a tunnel under Wisconsin Avenue, at a depth of roughly 130 feet below street level. The platform's depth poses a challenge to Metrorail passenger access.

Existing access is provided from the north of the platform, via an escalatorway connecting the station's underground mezzanine level with the bus level, about 20 feet below street level. A second, much shorter, set of escalators connects the bus level with street level, at the southwest corner of Wisconsin Avenue and Old Georgetown Road. An existing pedestrian tunnel also crosses under Wisconsin Avenue from the bus level to a second entrance point on the southeast corner of Wisconsin Avenue and East-West Highway.

A single elevator also provides access between the street and mezzanine levels. At street level, the elevator is located on the northwest corner of Wisconsin and Montgomery Avenues.

The station's bus level is mostly enclosed below a plaza and other development. It includes a bus terminal with seven bus bays serving 15 Metrobus and Ride-On bus routes, as well as the Bethesda 8 Trolley, which provides free shuttle service in the Bethesda central business district. The bus level also includes a kiss-and-ride lot with 26 parking spaces. Vehicular access to the bus bays and the kiss-and-ride lot is from the west, on Woodmont Avenue and Edgemoor Lane.

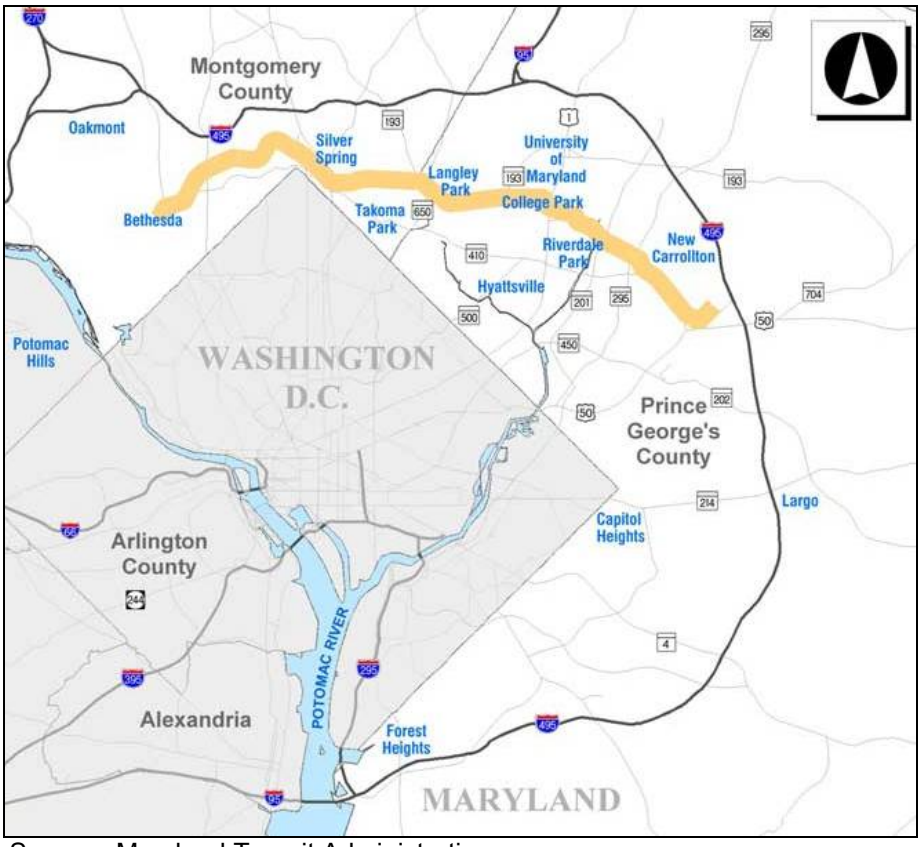
Vertical circulation between the mezzanine and center platform includes a single elevator and two escalators.

Bi-County Transitway

The proposed Bi-County Transitway would provide a high-capacity transit link between the Bethesda and New Carrollton Metrorail Stations, with stops at Silver Spring, College Park and intermediate points, as shown in Figure 2. The 14-mile route would provide direct connections between the Metrorail Red, Orange and Green Lines. Sometimes referred to as the Purple Line, the Bi-County Transitway evolved from the Capital Beltway Purple Line Study and the Georgetown Branch Transitway Study, which proposed to link Bethesda and Silver Spring on a shorter alignment.

Originally, the Georgetown Branch was established around 1900 to provide rail service between Silver Spring and Georgetown. After rail service ended, the corridor was identified as a potential transit corridor in the 1980s. Following feasibility studies, Montgomery County purchased the Georgetown Branch right-of-way in 1988. Portions of the alignment currently serve as the interim Capital Crescent Trail, a popular shared-use facility for pedestrians and bicyclists.

Figure 2: Bi-County Transitway Alignment



Source: Maryland Transit Administration

Several recent studies of the corridor have been undertaken:

- The Georgetown Branch Transitway/Trail Major Investment Study (MIS)/Draft Environmental Impact Statement (EIS) was completed in 1996. This study considered light-rail and a busway on the 4.4-mile section of the Georgetown Branch between Bethesda and Silver Spring.

- The Georgetown Branch Transitway Terminal Stations Study was conducted by the Washington Metropolitan Area Transit Authority (WMATA) in 2001, to provide technical support to the Final EIS. The study proposed configurations for the Bethesda and Silver Spring Stations, which were considered the termini of the line at that time.

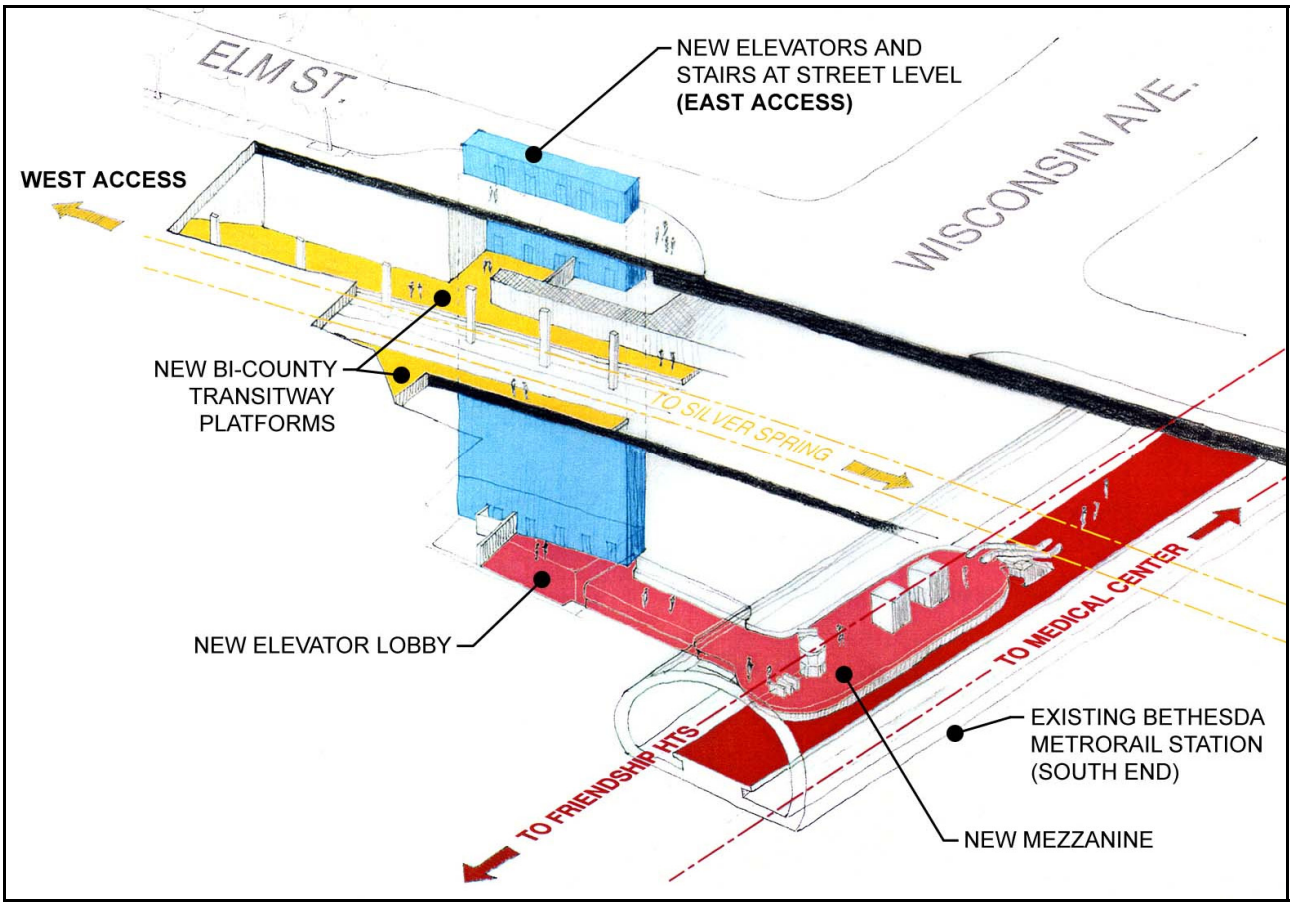
- The Maryland Transit Administration (MTA) is currently conducting the large-scale Bi-County Transitway Alternatives Analysis (AA)/EIS. MTA is looking at a variety of alternatives, including bus rapid transit (BRT) and light-rail transit (LRT); an alignment other than the Georgetown Branch right-of-way; and use of portions of existing roads for LRT.

The Bi-County Transitway's terminal station in Bethesda is proposed just west of Wisconsin Avenue and south of Elm Street. The platform would be one level below street level, as shown in

Figure 3. The Bi-County Transitway would be well above the existing Metrorail Red Line, and the platform would be near the south end of the existing Bethesda Metrorail platform.

For BRT alternatives, the transitway's Bethesda Station could also be located near the existing Metrorail Station's north entrance, in the same general vicinity as the existing bus bays.

Figure 3: Proposed Bethesda South Entrance Configuration



Source: Adapted from Georgetown Branch Transitway Terminal Stations Study Executive Summary

Figure 3 shows the Georgetown Branch Study's vertical circulation assumptions. Access to the Bi-County Transitway's Bethesda platform was proposed as a set of four elevators on the southwest corner of Wisconsin Avenue and Elm Street. The elevators would stop at the Bi-County Transitway level, 24.5 feet below street level, and would continue to the Metrorail Station, on a new mezzanine 122.5 feet below street level. This configuration would facilitate direct access to either transit route, as well as transfers between the two routes.

Because of the depth of the Metrorail platform, it was determined that escalator access to Metrorail at the south entrance would be prohibitive.

Access to the Bi-County Transitway Bethesda platform could also be provided via the existing Capital Crescent Trail to the west, which continues under the Apex Building to the intersection of Bethesda and Woodmont Avenues.

Study Purpose

The purpose of this study is to evaluate the Bethesda station facilities to determine their ability to accommodate the passenger traffic generated by the proposed south entrance and the proposed Bi-County Transitway. The following three future scenarios are considered:

- Option 1: No-build scenario, where existing transit service and infrastructure remain unchanged
- Option 2: South Entrance scenario, where no new transitway is assumed, but the south elevator access point is assumed to provide access to the Metrorail station
- Option 3: Bi-County Transitway scenario, where the transitway is assumed to be in place between Bethesda and New Carrollton, along with the new south elevator access point to serve both local and transfer access to Metrorail and the transitway

The study involved evaluation of existing and future land use, estimates of existing and future ridership levels on Metrorail and the Bi-County transitway, forecasts of new ridership generated by the south entrance, full evaluation of station features, such as elevators and fare gate aisles, and a review of the proposed station configurations for compliance with NFPA-130, the applicable transit station evacuation guideline published by the National Fire Protection Association.

Assumptions

General assumptions used throughout the study are as follows:

- Design year: 2030
- Future Red Line Metrorail service: 2.5-minute headways (24 trains per hour)
- Future Metrorail train consist: 8-car trains

EXISTING AND FUTURE LAND USE

The initial phase of the study allocated pedestrian trips to and from the existing and proposed entrances to the Bethesda Metrorail station and proposed Bi-County Transitway station based on the surrounding land use. The future land use in the Bethesda station area was determined based on MWCOG Round 6.4 forecasts for jobs and dwelling units. The data was examined at the Traffic Analysis Zone (TAZ) level for the year 2030.

The MWCOG TAZ data was further refined based on information provided by M-NCPPC. The additional data included smaller geographic increments, approaching the block level, for three TAZs in the Bethesda central business district (CBD) area. The M-NCPPC block data provided a more accurate forecast of the distribution of jobs and dwelling units within the TAZs located closest to the existing and proposed entrances. Figure 4 illustrates the location of TAZs and M-NCPPC blocks in the Bethesda area. Complete details about the existing and future land use forecast are included in Appendix A.

The primary access point to the proposed south entrance of the Bethesda station would be the elevators on Elm Street just west of Wisconsin Avenue. However, if the Bi-County Transitway is constructed, these elevators would also stop at the Bi-County Transitway level 24.5 feet below street level. This is also the same level as the current interim Capital Crescent Trail, which would serve as a secondary access point to the elevators and the Bi-County Transitway. The trail access point would shorten the walking distance from some blocks and eliminate the need for patrons to use the elevator to access the Bi-County Transitway. For this report, the primary street-level access is referred to as the east access point, and the secondary transitway-level access is referred to as the west access point.

Although there is a mix of uses in the station area, the higher density uses are concentrated around the station and consist of predominantly office space and supporting retail. As the distance from the station increases, so does the percentage of residential uses, which occur at lower intensities. Adding a south entrance to the Metrorail station would expand the catchment area for pedestrian trips in the Bethesda area as illustrated Figure 5 and Table 3.

Dwelling units within the station's catchment area increase by a relatively high 27 percent—larger than the 9 to 11 percent increase in employment. The percent increase in dwelling units is larger than for employment because of the concentration of employment near the existing station, whereas the expanded catchment area captures large residential areas. However, the number of new trips is much larger from employment land uses because the density of the residential uses is much lower, attracting far fewer trips per unit area.

Figure 4: Bethesda Area TAZs and M-NCPPC Blocks

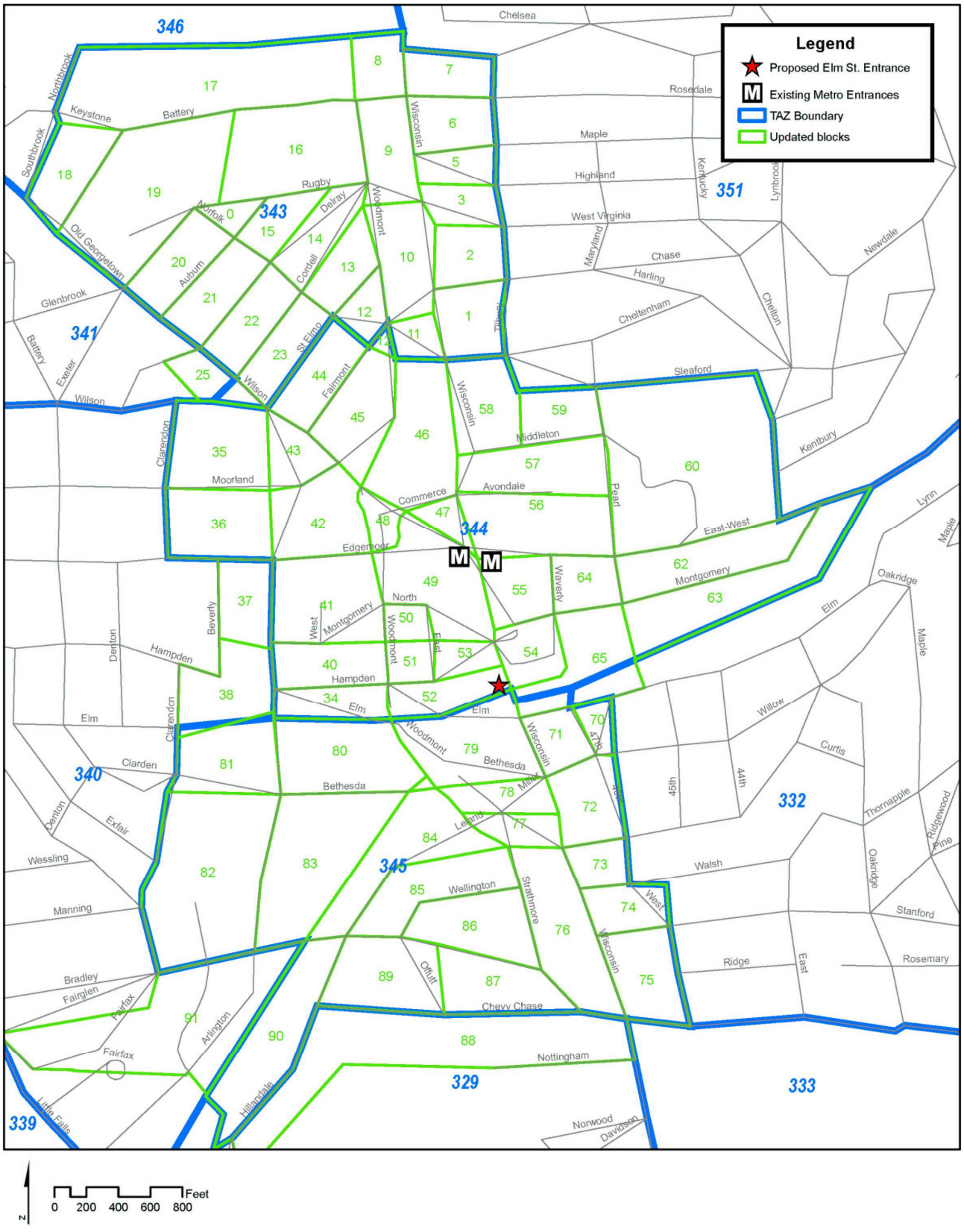


Figure 5: Expansion of Service Areas Caused by South Entrance

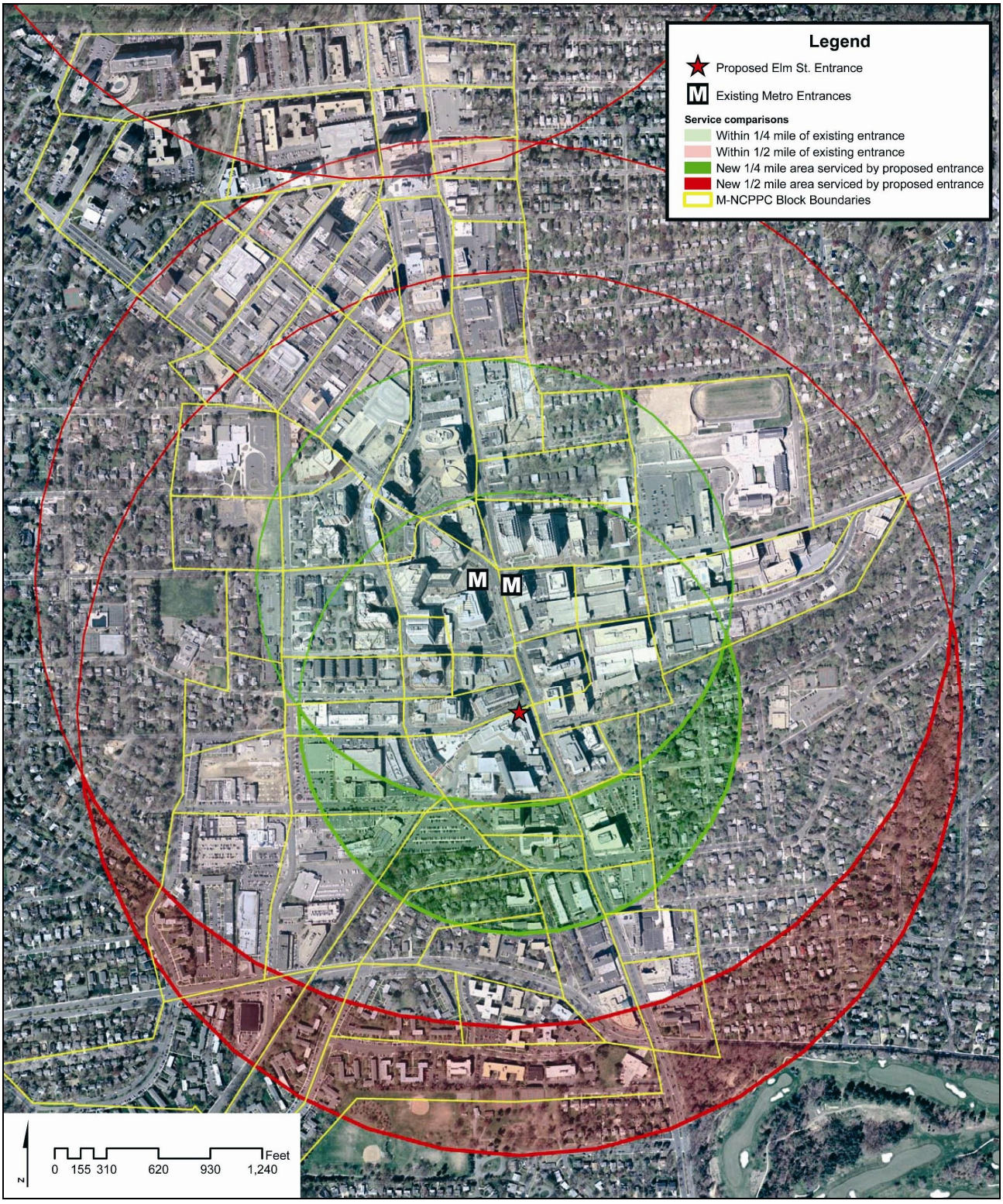


Table 3: Change in Area, Dwelling Units and Employment near Station Entrances

		Land Area (acres)	Dwelling Units		Employment	
			Existing	2030	Existing	2030
¼ mile radius	Within ¼ mile of existing entrance	12.77	1,349	2,891	21,096	29,104
	Within ¼ mile of existing or proposed entrance	16.75	2,261	3,680	23,509	32,296
	Increase Due to South Entrance	**3.98**	**912**	**789**	**2,413**	**3,192**
		31%	**68%**	**27%**	**11%**	**11%**
½ mile radius	Within ½ mile of existing entrance	48.78	3,869	6,237	33,282	45,267
	Within ½ mile of existing or proposed entrance	56.68	5,253	7,931	36,211	49,167
	Increase Due to South Entrance	**7.9**	**1,384**	**1,694**	**2,929**	**3,900**
		16%	**36%**	**27%**	**9%**	**9%**

Source: MWCOG Round 6.4

The allocation of Metrorail boardings in the morning peak period was determined based on the distribution of dwelling units in the station area and assumes that most morning trips are from home to work. The morning alightings were allocated based on the distribution of jobs in the station area, based on a similar assumption that most people exiting the station in the morning are on their way to their place of employment. The allocation of Metrorail trips in the afternoon peak period was the reverse of the morning, such that alightings in the afternoon follow the same pattern as boardings in the morning, and boardings in the afternoon follow the same pattern as alightings in the morning. The morning and afternoon allocation of Metrorail boardings and alightings between the north and south entrances are presented in Table 4.

Table 4: Allocation of Trips to Bethesda Metrorail Station Entrances by TAZ

TAZ	AM Boardings and PM Alightings		PM Boardings and AM Alightings	
	North Entrance	South Entrance	North Entrance	South Entrance
329	0%	100%	0%	100%
332	30%	70%	30%	70%
340	50%	50%	50%	50%
343	100%	0%	100%	0%
344	87%	13%	77%	23%
345	0%	100%	0%	100%
351	100%	0%	100%	0%

Source: Based on MWCOG Round 6.4 population and employment for 2030.

If a south entrance were constructed, all or most of the boardings and alightings from TAZs 329, 332, and 345 would use that entrance. All or most of the boardings and alightings from TAZs 343, 344, and 351 would use the existing north entrance. TAZ 340 would be split fairly evenly between the two entrances.

If the Bi-County Transitway is constructed, all Bi-County Transitway passengers are assumed to use the south entrance. Use of the north entrance would require a long trip through the Metrorail Station, including vertical circulation down the long north escalators and back up the south elevators, passing through the faregates and along the platform. This route would be unattractive to Bi-County passengers; the street-level route would require much less time.

However, if the Bi-County Transitway is constructed, both Metrorail passengers and Bi-County Transitway passengers may choose to use either the east or west access points to the south entrance. (The locations of the east and west access points are included on Figure 3.) The allocation of boardings and alightings by south entrance access point was determined based on the same method previously described for the Metrorail station entrances. The morning and afternoon allocations between the west and east access points are presented in Table 5.

It was assumed that the elevators would not stop at the Capital Crescent Trail if the south entrance were constructed without the Bi-County Transitway (under Option 2), to improve elevator operations.

Table 5: Allocation of Trips to South Entrance Access Points by TAZ

TAZ	AM Boardings/PM Alightings		PM Boardings/AM Alightings	
	West Access	East Access	West Access	East Access
329	100%	0%	100%	0%
332	0%	100%	0%	100%
340	50%	50%	50%	50%
343	0%	100%	0%	100%
344	0%	100%	0%	100%
345	89%	11%	44%	56%
351	0%	100%	0%	100%

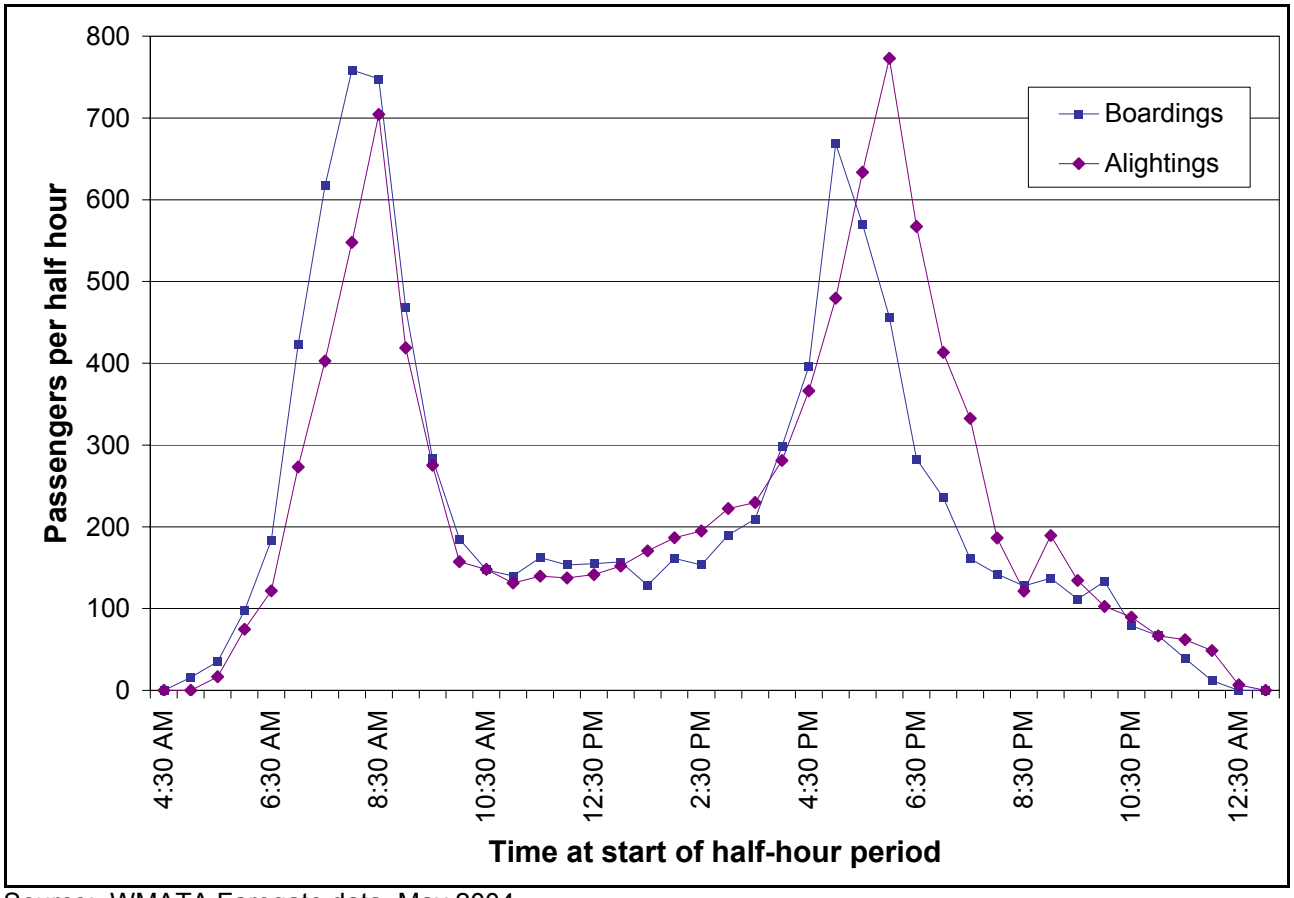
Note: Applies only to trips that are determined to use the South Entrance.
Source: Based on MWCOG Round 6.4 population and employment for 2030.

All or most of the boardings and alightings from TAZs 329 and 345 would use the west access point. All or most of the boardings and alightings from TAZs 332, 343, 344, and 351 would use the east access point. TAZ 340 would be split fairly evenly between the two access points.

EXISTING METRORAIL RIDERSHIP

Existing Metrorail ridership was determined from three mid-week days in May 2004, generally taken to be an average, representative period. May ridership levels were used as the baseline for computations of future ridership in this report; however, it is noted that ridership often surges above May levels, particularly during the summer. Figure 6 graphically presents the existing boarding and alighting patterns at the Bethesda station in 30-minute increments. Table 6 documents existing boardings and alightings during peak periods of various lengths and on a daily basis.

Figure 6: Existing Bethesda Metrorail Station Boardings and Alightings



Source: WMATA Faregate data, May 2004

The WMATA 2002 Metrorail Passenger Survey was used to determine the modes of access for Metrorail trips with origins at the Bethesda Station. The relevant results of the survey are presented in Table 7 and graphically in Figure 7.

Table 6: Existing Boardings and Alightings, Peak Periods and Daily

		Boardings	*Alightings*
AM Peak Period	30-min peak	759	704
	1-hr peak	1506	1252
	3-hr peak	3298	2622
PM Peak Period	30-min peak	668	773
	1-hr peak	1239	1407
	3-hr peak	2672	3233
Daily		9490	9701

Table 7: Access Modes for Metrorail Trips with origins at Bethesda

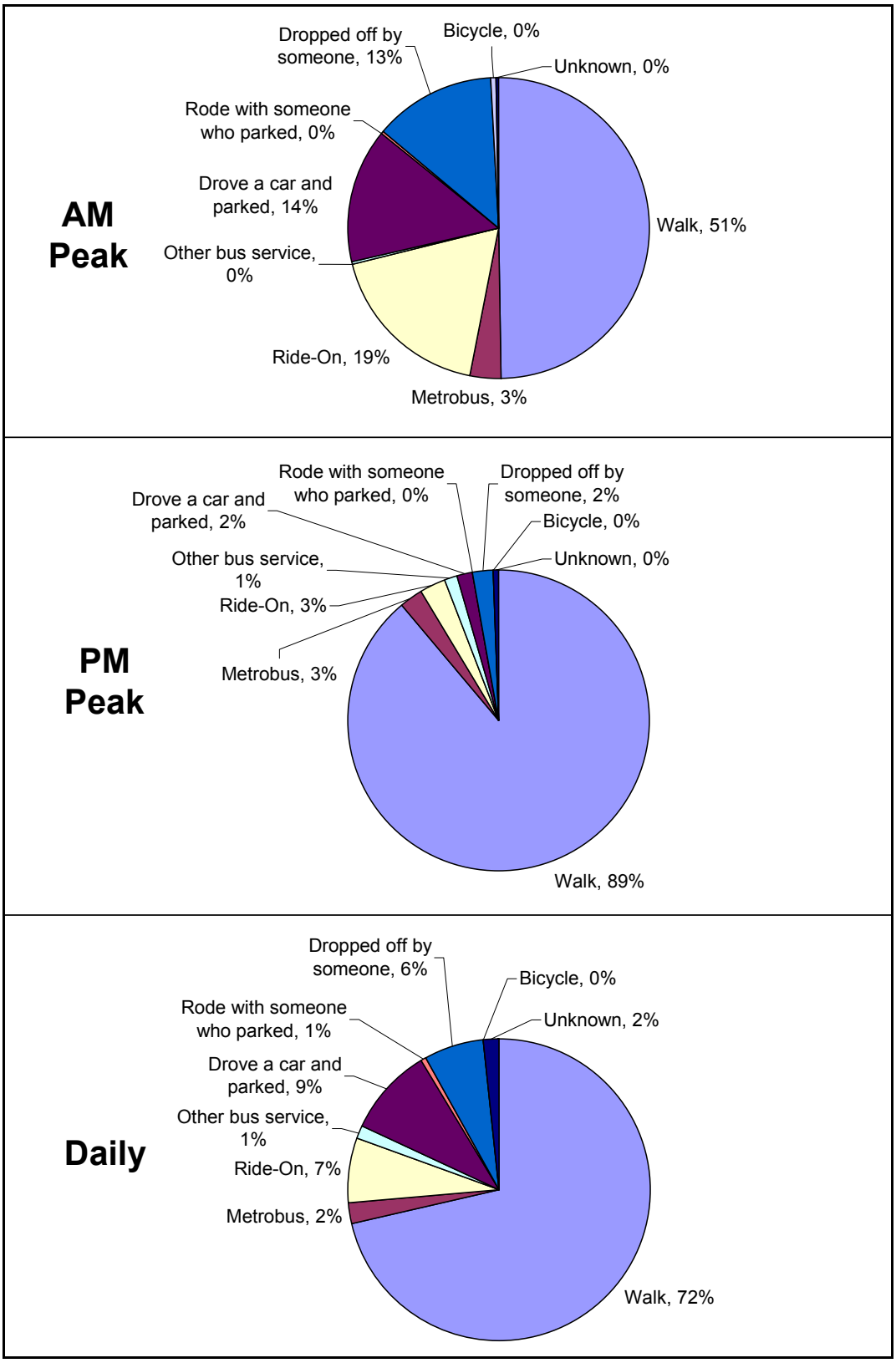
Access Mode	*AM Peak*		*AM Off Peak*		*PM Peak*		*PM Off Peak*		*Daily*	
	no.	*pct.*	*no.*	*pct.*	*no.*	*pct.*	*no.*	*pct.*	*no.*	*pct.*
Walk	1,464	49.8%	1,955	72.9%	1,561	88.8%	1,900	84.3%	6,880	71.4%
Metrobus	96	3.3%	0	0.0%	47	2.7%	63	2.8%	206	2.1%
Ride-On	528	18.0%	45	1.7%	47	2.7%	63	2.8%	683	7.1%
Other bus service	12	0.4%	45	1.7%	24	1.3%	42	1.9%	123	1.3%
Drove a car and parked	420	14.3%	409	15.3%	31	1.8%	42	1.9%	902	9.4%
Rode with someone who parked	12	0.4%	45	1.7%	0	0.0%	0	0.0%	57	0.6%
Dropped off by someone	384	13.1%	45	1.7%	39	2.2%	146	6.5%	615	6.4%
Bicycle	12	0.4%	0	0.0%	0	0.0%	0	0.0%	12	0.1%
Unknown	12	0.4%	136	5.1%	8	0.5%	0	0.0%	156	1.6%
Total	**2,941**	**100.0%**	**2,682**	**100.0%**	**1,757**	**100.0%**	**2,255**	**100.0%**	**9,635**	**100.0%**

Source: WMATA 2002 Metrorail Passenger Survey
Note: Rounding may affect sums.

Walking is the dominant access mode for Bethesda passengers. About half of passengers in the morning peak period walk to the station, increasing to nearly 90 percent in the afternoon peak period. Ride On Bus service is about six times more popular than Metrobus service as an access mode; Ride On is the second most frequent mode of access in the morning peak. About 14 percent of morning-peak passengers drove and parked, accounting for over 400 parked vehicles in the vicinity of the station.

A review of egress mode data from the Metrorail Passenger Survey shows patterns that are largely symmetric with the access mode data presented in Table 7 and Figure 7.

Figure 7: Access Modes for Metrorail Trips with origins at Bethesda



Source: WMATA 2002 Metrorail Passenger Survey

RIDERSHIP DEMAND ANALYSIS

Two methodologies were used to forecast future ridership. First, the MWCOG travel forecasting model was used to compare ridership under existing, No-build, and Bi-County Transitway scenarios. However, the model is not the best way to predict new Metrorail demand that would be induced by providing better access through a south entrance. As such, the south entrance was evaluated using the methodology outlined in WMATA's *Development-Related Ridership Survey* (1987, 1989), coupled with the land use forecast discussed earlier. Each of these methods is outlined in further detail below.

MWCOG Travel Forecasting Model

WMATA provided a copy of the MWCOG Version 2.1 D/TP+#50 travel forecasting model with Round 6.4A of the MWCOG Cooperative Forecasts on demographic data, and it was initially expected that this Version D model would be used exclusively in the study. However, the Version D model does not include the Bi-County Transitway, which is the most critical component of this study. In the earlier Georgetown Branch Transitway study, the Bi-County Transitway and its supplementary network of feeder buses were coded and tested as one of the alternatives under the MWCOG Version 2.1 C model with Round 6.2 Cooperative Forecasts. Modeling assumptions used in the earlier study and carried forward to this study are presented in Appendix B.

It was initially expected that this earlier coding of the Bi-County Transitway could be easily adapted into the new MWCOG Version D model. However, a review of the Version D model indicated that the Bi-County Transitway coding could not be readily converted from Version C model because of significant changes in the structure and algorithms of the Version D model.

Because of these constraints, the Version C model that includes the Bi-County Transitway was selected for use in this study, with the following refinements to reflect the needed updates:

- Metrorail service in the Version 2.1 C model was replaced with the service from the "Dulles Corridor Final EIS Full Build after 2015" plan. Appendix C compares Metrorail service assumptions between the original 2025 Constrained Long Range Plan (CLRP) transit network and the updated 2030 plan used in this study.
- Round 6.4A land use input data for the year 2030 replaced the Round 6.2 data from 2025 used in the Version C model. As such, the impacts of the most recent land use assumptions on Bi-County Transitway ridership were assessed. Appendix D further illustrates the differences among land use forecasts for TAZs in the Bethesda CBD.
- A separate node was added to represent the Bethesda Bi-County Transitway station to document transfers between the transitway and Metrorail.

Because the Version D model was not used in the study, a sensitivity analysis was undertaken to document the differences in model results attributable to the use of the Version C model. The results of this analysis are discussed later in this section.

In the model, the transit vehicle mode was coded as light rail. Because BRT and LRT are expected to have only minor operational differences, this study does not directly consider changes to transit vehicle mode.

To develop ridership forecasts for the Bethesda Station based on the demand analysis from the MWCOG travel forecasting model, prior to adding a new south station entrance, the following three scenarios were studied:

- Existing 2005 conditions
- Future 2030 No-build (does not include Bi-County Transitway)
- Future 2030 Build (includes Bi-County Transitway)

The results of the existing conditions scenario were compared to actual ridership, forming a basis for adjusting future ridership forecasts from the model.

The MWCOG model is only able to simulate the morning peak and off-peak periods. Afternoon peak-period data was synthesized by assuming that trip distribution is symmetric to the morning peak, and by assigning afternoon trips to times of the day that are consistent with existing patterns.

The raw model outputs and adjusted results for these three scenarios were summarized into three categories: regional transit demand, Bethesda Station demand, and Bethesda local access demand. Each of these categories is discussed further as follows.

Regional Transit Demand

Part I of Appendix E presents the differences in regional transit demand among the scenarios. Regional transit demand accounts for changes in transit trip patterns on a regional basis, including the following elements:

- Modeled transit person trips by trip purpose, time period and access mode
- Modeled rail trips by time period and access mode
- Observed rail trips by time period from May 2004
- Future adjusted rail trips by time period based on observed rail trips and the relationship between modeled rail trips of different scenarios

Bethesda Station Demand

Bethesda Station demand, as shown in Appendix E, Part II, accounts for transit trip patterns at the Bethesda station, including the following elements:

- Metrorail and Bi-County Transitway boardings and alightings by time period, access mode, and direction of travel
- Observed rail boarding and alighting by time period from May 2004
- Modeled rail transfers between Metrorail and the Bi-County Transitway by time period and access mode
- Future adjusted boarding and alighting, adjusted transfers between Metrorail and the transitway, and local (non-transfer) access demand by time period based on observed boarding and alighting data and the relationship between modeled rail boarding and alighting data of different scenarios

Bethesda Station Local Access Demand

Bethesda local access demand, as shown in Appendix E, Part III, represents direct access and egress from the Bethesda area to Metrorail and the Bi-County Transitway. It differs from station demand

in that it excludes passengers transferring between Metrorail and the transitway, focusing only on those passengers who access the Bethesda Station by other modes. The following elements are included:

- Modeled local boarding and alighting rail demand by time period, access mode, and direction to and from station
- For passengers who walk to the station, the boarding and alighting demand was further segregated by origin and destination TAZ.
- Future adjusted local rail demand by time period, access mode, and direction

The rail ridership estimates derived from the above modeling procedure represented the basic demand without the new south entrance, with and without Bi-County Transitway.

South Entrance

A new south entrance would provide significant benefits for current Metrorail users and would attract new riders because of the shorter walking access time for areas south of the station. The increase in Bethesda Metrorail demand due to the addition of a south entrance was computed by calculating the reduction in walking distance for individual M-NCPPC blocks south of the station. The differences in walking distances were converted to differences in mode share using the *Development-Related Ridership Survey*.

The use of the M-NCPPC block land use forecasts allows more accurate forecasting than would be possible in the MWCOG model, because the model's land use forecast does not have nearly as much detail about the Bethesda area.

Appendix F presents the calculations and results of the south entrance analysis for each M-NCPPC block. For blocks where a reduction in walking distance can be achieved, the resulting difference in transit mode share was applied to the block's 2030 population and employment forecast to determine the likely percent increase that the south entrance would cause in 2030 Metrorail ridership levels among patrons who access the station on foot. (The south entrance is not expected to increase ridership among patrons who access the station by other modes, such as by bus or car, because it would not significantly change riders' access times.)

The results show that the south entrance would induce a 3.2 percent increase in pedestrian-based Metrorail ridership generated by residential areas, and a 7.5 percent increase in pedestrian-based ridership generated by employment areas. Overall, the weighted average of both land uses shows that the south entrance could be expected to increase pedestrian-based Metrorail ridership by 6.2 percent.

The magnitude of the mode share increase, 6.2 percent, is much smaller than would be suggested by Figure 5 and Table 3. Although the population of the ¼-mile and ½-mile transit catchment areas increases by 27 percent with a south entrance, individual households observe relatively small reductions in walking distance—never exceeding the distance between the entrances of about 800 feet.

Model Version Sensitivity

As discussed earlier, the most recent version of the MWCOG model (Version D) was not able to be used in the current study because of difficulties with coding the Bi-County Transitway. Instead, this study used the Version C model, in which the Bi-County Transitway had been coded as part of an earlier project.

Version D includes several changes to transportation facilities in the region that are not included in Version C. Among these changes are the additions of the Inter-County Connector and the Corridor Cities Transitway. A sensitivity analysis was conducted to determine whether these facility changes would significantly affect ridership levels in the Bethesda area. The sensitivity analysis compared transit person trip-table patterns from this study's 2030 No-build scenario with the 2030 CLRP Version 2.1 D model. By using the total boardings and alightings for the Bethesda area and total regional transit person trips as measures for computing quantitative effects on local access and transfer rail trips respectively, the results are summarized in Part IV of Appendix E.

The sensitivity analysis showed only minor changes in forecast ridership levels, both in the Bethesda area and region-wide.

Ridership Summary

The final ridership forecasts, presented in Table 8 and Figure 8, were computed by combining the results of the MWCOG methodology with the results of the South Entrance methodology. Results for the No-build Option (Option 1) are identical to those in the MWCOG forecast. The South Entrance Option (Option 2) was computed by applying the mode share increase caused by the south entrance to the appropriate time period, land use, and travel access modes of Option 1.

The Bi-County Transitway Option (Option 3) was computed by applying the south entrance mode share increase to the MWCOG scenario with the Bi-County Transitway in place.

The ridership in Table 8 was assigned to the closer station entrance, according to the allocations developed for Table 4. However, it was assumed that all passengers using the Bi-County Transitway would use the south entrance, because using the north entrance would require traveling through the Bethesda Metrorail Station, an awkward trip because of the large amount of vertical travel.

Table 8: Adjusted Ridership Summary, 2030

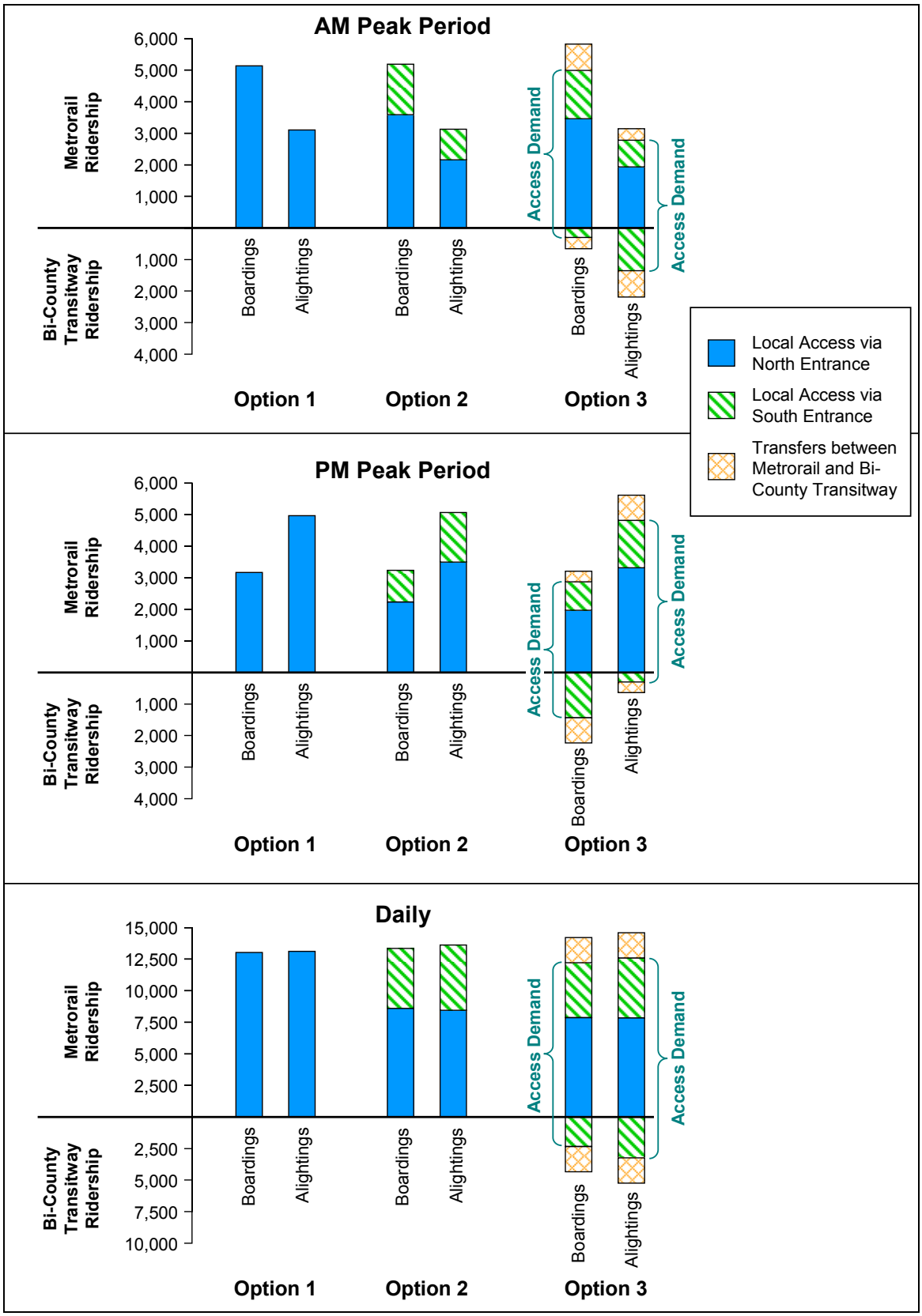
AM Peak Period		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	5,100	3,100	0	0	0	0	**5,100**	**3,100**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**5,100**	**3,100**	**0**	**0**	**0**	**0**	**5,100**	**3,100**
Option 2: South Entrance without Bi-County	North	3,600	2,200	0	0	0	0	**3,600**	**2,200**
	South	1,600	1,000	0	0	0	0	**1,600**	**1,000**
	Total	**5,200**	**3,200**	**0**	**0**	**0**	**0**	**5,200**	**3,200**
Option 3: South Entrance with Bi-County	North	3,500	1,900	0	0	0	0	**3,500**	**1,900**
	South	1,500	900	300	1,400	400	800	**1,900**	**2,200**
	Total	**5,000**	**2,800**	**300**	**1,400**	**400**	**800**	**5,300**	**4,200**

PM Peak Period		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	3,100	5,000	0	0	0	0	**3,100**	**5,000**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**3,100**	**5,000**	**0**	**0**	**0**	**0**	**3,100**	**5,000**
Option 2: South Entrance without Bi-County	North	2,200	3,500	0	0	0	0	**2,200**	**3,500**
	South	1,000	1,600	0	0	0	0	**1,000**	**1,600**
	Total	**3,200**	**5,100**	**0**	**0**	**0**	**0**	**3,200**	**5,100**
Option 3: South Entrance with Bi-County	North	2,000	3,300	0	0	0	0	**2,000**	**3,300**
	South	900	1,500	1,400	300	800	300	**2,300**	**1,800**
	Total	**2,900**	**4,800**	**1,400**	**300**	**800**	**300**	**4,300**	**5,100**

Daily		*Metrorail Bethesda Station*		*Bi-County Transitway Bethesda Station*		*Transfers between Metrorail and Bi-County*		***Total Access Demand (excludes transfers)***	
	Entrance	*Boardings*	*Alightings*	*Boardings*	*Alightings*	*From Metro to Bi-County*	*From Bi-County to Metro*	***Boardings***	***Alightings***
Option 1: No-Build	North	13,000	13,100	0	0	0	0	**13,000**	**13,100**
	South	0	0	0	0	0	0	**0**	**0**
	Total	**13,000**	**13,100**	**0**	**0**	**0**	**0**	**13,000**	**13,100**
Option 2: South Entrance without Bi-County	North	8,500	8,400	0	0	0	0	**8,500**	**8,400**
	South	4,700	5,100	0	0	0	0	**4,700**	**5,100**
	Total	**13,300**	**13,500**	**0**	**0**	**0**	**0**	**13,300**	**13,500**
Option 3: South Entrance with Bi-County	North	7,900	7,800	0	0	0	0	**7,900**	**7,800**
	South	4,400	4,800	2,400	3,200	2,000	2,000	**6,700**	**8,000**
	Total	**12,200**	**12,600**	**2,400**	**3,200**	**2,000**	**2,000**	**14,600**	**15,800**

Note: Figures are rounded to the nearest 100 riders, which may affect sums.

Figure 8: Adjusted Ridership Summary, 2030



ANALYSIS OF CAPACITY CONSTRAINTS

The infrastructure requirements at each entrance to the Bethesda Station were evaluated based on the forecasted ridership levels. At each point of access, each of the following station elements were analyzed:

- Vertical circulation: elevators, escalators and stairways
- Fare gate aisles
- Farecard vendors

The design criteria used for the capacity analysis are presented in Table 9, sourced to their use in other recent WMATA studies.

Table 9: Assumed Metrorail Station Capacity Criteria

Item		***Source***
Peaking factor for alighting passengers	1.28	Convention Center Metrorail Expansion Program, page 2
Escalator flow rate	83 ppm*	Technical Report and Program for the Mount Vernon Square-UDC Station to Complement the New Washington Convention Center, 1997.
Up stair flow rate	55 ppm	Core Capacity Study, table on page 21, modified per Convention Center Program
Down stair flow rate	55 ppm	Core Capacity Study, table on page 21
Percent of passengers using farecard vendor	30%	Convention Center Metrorail Expansion Program, page 2
Farecard vendor peaking factor	1.1	Convention Center Metrorail Expansion Program, page 2
Farecard vendor transactions per minute	2.5	Concurrence among Core Capacity Study and Convention Center Program
Fare gate aisle flow rate	32 ppm	Average for the range (25 to 40 ppm) as cited in the Transit Capacity and Quality of Service Manual
Ascent/descent rate of high-speed elevator	350 ft/min	Courthouse Metrorail Station Access Study, Appendices I, IV
Elevator acceleration and deceleration time	2 sec	Courthouse Metrorail Station Access Study, Appendices I, IV
Elevator load and unload time per passenger	1 sec	Courthouse Metrorail Station Access Study, Appendices I, IV
Elevator door cycle time	6.22 sec	Courthouse Metrorail Station Access Study, Appendices I, IV
Elevator cab passenger capacity	9.6 passengers	Courthouse Metrorail Station Access Study, Appendices I, IV

*ppm = passengers per minute

South Entrance

At the south entrance, passenger demand predicted according to the ridership forecast was allocated to the east and west access points in accordance with Table 5.

Elevators

Of particular concern at the south entrance is the new bank of elevators that would connect street level with the Metrorail Station and, in the case of Option 3, the transitway station. Because the elevators would stop at three levels under this latter option, they were evaluated using an iterative approach to determine the cycle length and number of passengers per elevator cab. The analysis considered the peak 30-minute ridership during both morning and afternoon peaks.

The results of the analysis show that three elevator cabs are required to serve passenger demand under Option 2 and five cabs are required under Option 3. The elevator requirement is higher when the Bi-County Transitway is in place not only because the passenger load increases, but also because the elevators are required to serve an additional level, increasing travel times.

One additional cab should be considered under both options so that service can continue when one cab is taken out of service for maintenance or repair.

Elevator capacity could be increased using several methods, such as increasing speed or enlarging the cabs to accommodate more passengers. These or other similar capacity improvements may reduce the number of elevator cabs required.

Under Option 3, other studies have suggested that escalators or stairways be provided between street level and Bi-County Transitway level, in addition to elevators. Escalators or stairs would improve vertical circulation, but they would not reduce the number of elevator cabs required. Elevator cabs would carry their maximum loads between Bi-County Transitway level and Metrorail level, so providing additional circulation between the transitway and street levels does not significantly reduce the need for elevator capacity. (Additional vertical circulation is also not expected to be needed for emergency egress of the Bi-County Transitway platform because of its high-capacity at-grade egress to the west.)

Detailed results of the elevator analysis are presented in Appendix H.

Infrastructure

Aside from the elevator access, the infrastructure required to serve the south entrance is not extensive. Again, peak 30-minute flows were evaluated during morning and afternoon periods to determine the infrastructure needs.

In both Option 2 and Option 3, vertical circulation between the platform and mezzanine could be served easily by one pair of escalators. This system would operate at well below half of its capacity, even during peak times. It would remain below capacity even if one or both of the escalators were replaced with a static stairway of similar width. (Including a stairway offers emergency egress advantages as well.) To comply with the Americans with Disabilities Act (ADA), it is also recommended that elevator access be provided between mezzanine and platform.

A minimum of two elevators is recommended so that service can continue during maintenance or repair.

Two fare card vendors would be sufficient to serve demand in Option 2, increasing to three in Option 3.

Passenger volume suggests that two standard fare gate aisles would be required to serve demand in Option 2 and three would be required in Option 3. In both options, two additional ADA-accessible aisles are recommended, as is one additional standard aisle as a spare. This results in a total of five aisles in Option 2 and six aisles in Option 3.

Further details about the infrastructure analysis are included in Appendix I.

North Entrance

Passenger volume at the north entrance is highest in Option 1. It drops significantly in Option 2, as many existing passengers switch to the south entrance, and it drops further in Option 3 when Bi-County Transitway passengers shift to the south entrance.

Infrastructure

The existing bank of three escalators from street level to mezzanine level is expected to remain below capacity, even in the highest-volume Option 1. The single elevator between street and mezzanine provides ADA access, but a second elevator would be desirable, particularly in Option 1, when elevator access is not provided in a new south entrance.

Vertical circulation between mezzanine and platform, provided by two escalators and a single elevator, is expected to be about 7 percent over capacity in Option 1. An additional unit of exit is recommended in Option 1 to offset this capacity shortfall; a static stairway is the most effective way to increase capacity because of its emergency egress advantages.

In Options 2 and 3, the existing platform-to-mezzanine circulation remains below capacity, but the bank of two escalators does not provide for redundant service. When one escalator is removed from service, congestion is expected to result. In all options, a second platform elevator would be desirable to provide redundant ADA accessibility.

The existing seven fare card vendors at the north entrance are predicted to be sufficient in Option 1. The farecard vendor requirement drops to five in Options 2 and 3.

The north entrance features seven standard fare gate aisles and one ADA-accessible aisle. Under Option 1, only five standard aisles are needed to serve peak demand, with a sixth aisle as a spare. A second ADA aisle would be desirable; sufficient space exists to add an ADA aisle to the existing fare gate array without reconfiguring the kiosk or existing fare gate aisles. Under Options 2 and 3, three standard fare gate aisles are needed to serve peak demand, two fewer than under Option 1. In both Options 2 and 3, an additional ADA aisle would be desirable.

Further details about infrastructure elements at the north entrance are presented in Appendix I.

Infrastructure Summary

Table 10 provides a summary of the existing and required infrastructure elements for both north and south entrances for the three options under consideration.

If a south entrance is constructed, it would reduce the passenger load at the north entrance, which has ample reserve capacity. As such, it is recommended that bus-to-Metrorail transfers remain focused near the north entrance, rather than shifting some to the south entrance, where the elevator access point will have less reserve capacity to handle additional traffic.

Table 10: Summary of Bethesda Station Infrastructure Requirements

Infrastructure Element			North Entrance				South Entrance	
			Existing	Option 1	Option 2	Option 3	Option 2	Option 3
Vertical Circulation	Street to mezzanine	Escalators	3	3	2	2	0	0
		Elevators*	1	2	2	2	3**	5**
		Stairs	0	0	0	0	1	1
	Mezzanine to platform	Escalators	2	2	2	2	1	1
		Elevators*	1	2	2	2	2	2
		Stairs	0	1	0	0	1	1
Farecard Vendors			7	7	5	5	2	3
Fare Gate Aisles		Standard	7	5	3	3	2	3
		ADA	1	2	2	2	2	2
		Spare	0	1	1	1	1	1
		Total	8	8	6	6	5	6

* A minimum of two elevators is recommended for redundancy.
** One additional elevator should be considered for redundancy.

Emergency Egress

Emergency egress requirements for transit stations are set forth in *NFPA-130: Standard for Fixed Guideway Transit and Passenger Rail Systems,* published by the National Fire Protection Association most recently in 2003. As per section 1.3.1 of NFPA-130, the standard only applies "to new fixed guideway transit and passenger rail systems and to extensions of existing systems." Therefore, it is WMATA's position that the standard does not apply to stations within the original Metrorail system, but only to new stations on extensions of that system. As such, adding a new entrance to the Bethesda Station would not require the station to comply with NFPA-130.

In order to assess the potential benefits of a new entrance, an emergency egress analysis of the Bethesda Station was conducted, using the parameters specified by NFPA-130. The analysis showed the following:

- The time required to evacuate the station platform at the existing Bethesda Station is 15.3 minutes in the morning peak period and 14.9 minutes in the afternoon peak. Under Option 1 (future No-build scenario), platform evacuation times would increase to 20.9 minutes in the morning peak and 19.6 minutes in the afternoon peak.

- At the Bethesda Station, the time required to evacuate from the most remote point on the platform to a point of safety is 18.6 minutes during the morning peak and 18.2 minutes in the afternoon peak. Under Option 1, the station evacuation times would increase to 24.2 minutes in the morning peak and 23.0 minutes in the afternoon peak.

Adding a south entrance improves egress times dramatically. If the station elements in Table 10 are provided, the platform evacuation times under Option 2 decrease to 7.0 minutes in the morning peak hour and 6.6 minutes in the afternoon peak hour. Station evacuation times decrease to 10.4 minutes in the morning peak hour and 10.0 minutes in the afternoon peak hour. Both of these times are significant improvements over conditions in Option 1.

Conditions in Option 3 are very similar to Option 2, with identical platform evacuation times and only slightly longer station evacuation times during the morning peak period.

Detailed calculations of emergency egress features are presented in Appendix J for the Metrorail Station with the infrastructure as shown in Table 10.

In Option 3, the Bethesda Bi-County Transitway Station is expected to satisfy NFPA requirements easily, because patrons can exit that station to a point of safety via the west access, along the Capital Crescent Trail, without using any vertical circulation features and without passing through fare gates.

Appendix A: Summary of Jobs and Dwelling Units by Block, Bethesda CBD

Block*	Employees			Dwelling Units		
	Existing	Net Change	Future	Existing	Net Change	Future
1	44.7	234.7	279.4	34	93	127
2	97.9	40.4	138.3	4	0	4
3	75.5	86.6	162.1	7	0	7
4	12.2	161.5	173.7	2	104	106
5	21.8	51.5	73.3	11	164	175
6	39.1	16.7	55.8	16	0	16
7	18	9.9	27.9	7	0	7
8	365.7	48	413.7	0	127	127
9	1,116.5	112.7	1,229.2	245	0	245
10	357	123.4	480.4	112	122	234
11	143.3	59.2	202.5	0	0	0
12	1,009.3	150.1	1,159.4	0	0	0
13	197.7	288.6	486.3	0	103	103
14	92	78.1	170.1	260	314	574
15	234.3	83.9	318.2	0	56	56
16	1,061.3	275.9	1,337.2	273	418	691
17	0	0	0	749	88	837
18	0	0	0	89	0	89
19	0	0	0	264	0	264
20	520.1	134.4	654.5	8	7	15
21	230	56.2	286.2	0	0	0
22	356.8	140.5	497.3	0	0	0
23	763.9	162.7	926.6	0	0	0
24	34.5	45.2	79.7	0	0	0
25	180.4	26.9	207.3	0	0	0
26	0	41.2	41.2	0	-1	-1
27	0	0	0	0	0	0
28	0	0	0	0	0	0
29	0	0	0	0	0	0
30	0	0	0	0	0	0
31	0	0	0	0	0	0
32	0	0	0	0	0	0

Table continues, next page

Block*	Employees			Dwelling Units		
	Existing	Net Change	Future	Existing	Net Change	Future
33	0	0	0	0	0	0
34	0	0	0	0	0	0
35	0	0	0	0	0	0
36	0	0	0	2	0	2
37	0	0	0	0	0	0
38	0	0	0	0	0	0
39	195.9	235.7	431.6	0	0	0
40	558.8	107.7	666.5	60	95	155
41	38.1	150.1	188.2	284	253	537
42	71	95.9	166.9	586	5	591
43	707.2	105.2	812.4	0	0	0
44	873.7	238.5	1,112.2	0	21	21
45	371.1	76.9	448	0	264	264
46	2,390.8	1477	3,867.8	0	0	0
47	669.8	196	865.8	0	0	0
48	0	252.4	252.4	312	0	312
49	3,831.6	646.5	4,478.1	0	0	0
50	0	0	0	0	0	0
51	0	0	0	37	0	37
52	1,021.4	141.8	1,163.2	1	0	1
53	384.1	655.8	1,039.9	0	0	0
54	754.1	181	935.1	0	0	0
55	1,219.3	181.4	1,400.7	0	0	0
56	2,830.9	483.8	3,314.7	204	0	204
57	107.6	75.2	182.8	59	0	59
58	186.7	1,048.7	1,235.4	0	263	263
59	0	0	0	27	0	27
60	424	142	566	18	49	67
61	0	0	0	12	0	12
62	2,261.6	812.5	3,074.1	371	-1	370
63	1,545.4	454.1	1,999.5	0	0	0
64	660.5	698.3	1,358.8	0	0	0
65	985.1	271.4	1,256.5	0	198	198

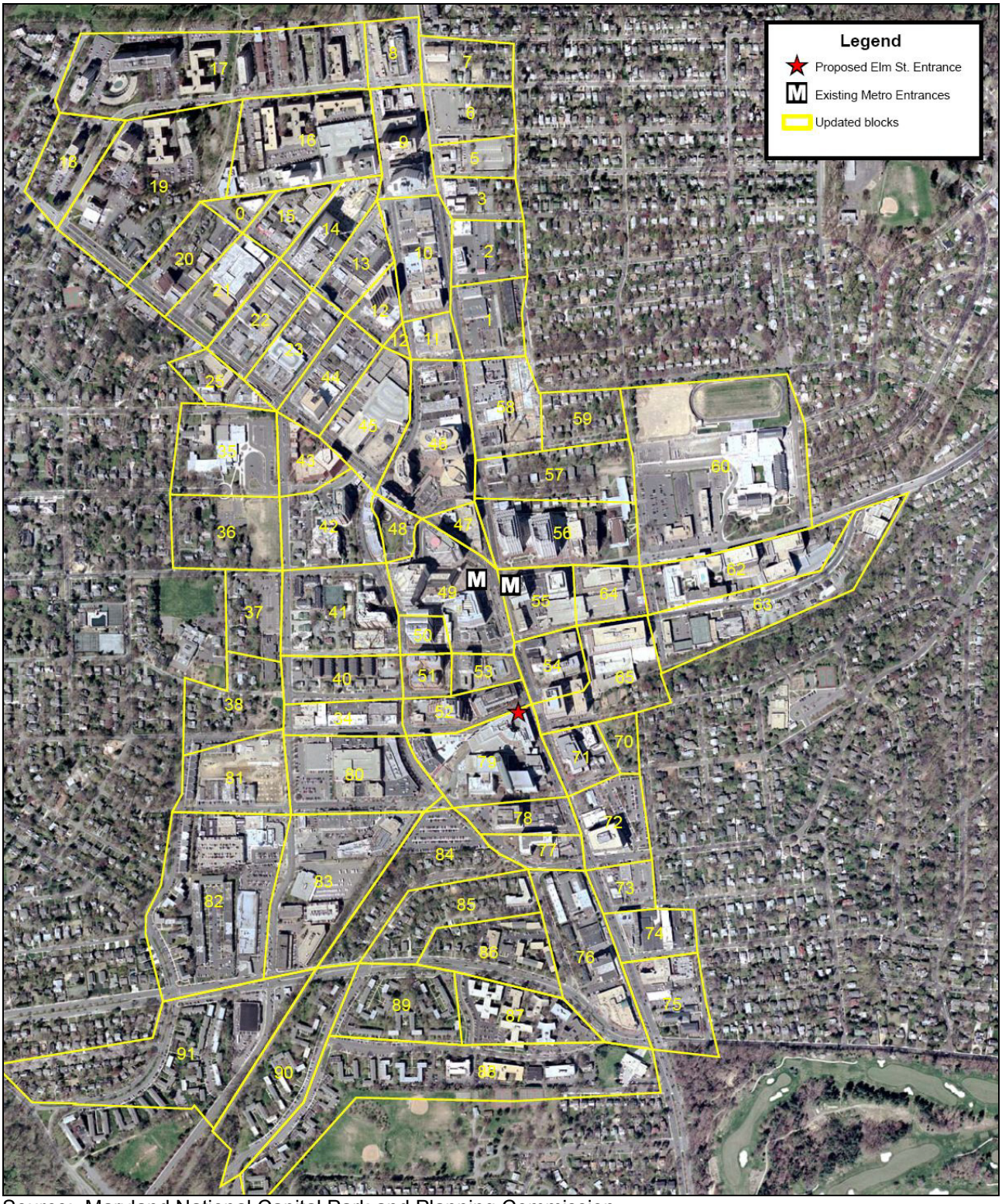
Table continues, next page

Block*	Employees			Dwelling Units		
	Existing	Net Change	Future	Existing	Net Change	Future
66	392	58.3	450.3	0	0	0
67	0	0	0	0	0	0
68	0	0	0	0	0	0
69	0	0	0	0	0	0
70	0	0	0	0	0	0
71	739.4	145.7	885.1	3	0	3
72	888.1	132.2	1,020.3	0	0	0
73	31	69.1	100.1	0	2	2
74	226.2	46	272.2	1	21	22
75	221.4	71.9	293.3	0	16	16
76	402.1	360.4	762.5	54	103	157
77	0	25.9	25.9	149	60	209
78	38.7	36.9	75.6	247	10	257
79	2,070.2	386.2	2,456.4	0	0	0
80	1,075.7	434.4	1,510.1	0	180	180
81	168.5	205.8	374.3	63	0	63
82	383.7	123.5	507.2	306	0	306
83	1342	418	1760	0	105	105
84	0	32.6	32.6	21	100	121
85	0	0	0	70	0	70
86	0	0	0	179	0	179
87	0	0	0	369	0	369
88	28.9	4.3	33.2	274	17	291
89	0	0	0	88	0	88
90	0	0	0	110	0	110
91	43	62.6	105.6	103	-1	102
TOTAL	**37,111.6**	**13,770**	**50,881.6**	**6,091**	**3,355**	**9,446**

Source: Maryland National Capital Park and Planning Commission, 2004

* Block number designations per M-NCPPC, as shown on attached map.

Bethesda CBD Block Map



Source: Maryland National Capital Park and Planning Commission

Appendix B: Modeling and Operating Assumptions

Bi-County Transitway Assumptions

Travel Demand Model

- *Model Version:* MWCOG Version 2.1/TP+, Release C
- *Demographic Forecast:* Round 6.2 of the MWCOG Cooperative Forecasts
- *Background Networks:* FY 2003-2008 TIP/2002 CLRP Air Quality Conformity Networks adopted in July, 2002.
- *Horizon Year:* 2025

Transit Operations

- *Mode:* Light Rail
- *Vehicle:* Low-floor, 60 seats, 60 standees
- *Consist:* Peak: 2-car trains; Off-Peak: 2-car trains
- *Fleet:* Bethesda to New Carrollton: 47 cars (including 8 spares)
- *Travel Time:* Bethesda to New Carrollton: 32 min (27 mph)
- *Fares:* LRT uses Metrorail fare structure

Rail Operations

Rail operations are as coded in the CLRP, adding the Purple Line between Bethesda and New Carrollton Metrorail stations. The following additional transitway stations are coded:

- Chevy Chase Lake
- West Silver Spring
- Silver Spring Metrorail station
- New Hampshire Avenue
- University of Maryland West
- University of Maryland East
- College Park Metrorail station
- Riverdale Road

Headways are assumed as 6 minutes during peak periods, 10 minutes midday and early evening, and 15 minutes in late evening.

Bus Operations

Bus operations are as coded in the CLRP with the following changes:

METROBUS

- 84, 85 - code to serve the Riverdale LRT station
- C2 – code to serve the New Hampshire, UM West, and UM East LRT stations
- C4 – code to serve the New Hampshire LRT station
- C8 – code to serve the UM West and UM East LRT stations
- F4 – code to serve the Riverdale LRT station
- F6 – eliminate, duplicates the Purple Line
- F8 – code to serve the New Hampshire LRT station
- J1 – terminate at proposed Chevy Chase Lake LRT station
- J2, J3 – reduce frequency to 20 minutes each
- J4 – eliminate
- J5 – reroute along Rockville Pike to the Bethesda Metrorail Station
- K6 - code to serve the New Hampshire LRT station
- L7, L8 – code to serve the Chevy Chase Lake LRT station
- R3 – code to serve the UM West LRT station

RIDE-ON

- 1 – reroute to serve the proposed West Silver Spring LRT station
- 3 & 5 - code to serve the Woodside station

THE BUS

- G – code to serve the UM East LRT station
- 14 – code to serve the Riverdale LRT station

STATION SERVICE (new stations)

- Chevy Chase Lake – Metrobus J1, L7, L8
- West Silver Spring – Ride-On 1
- New Hampshire Av. –Metrobus C2, C4, F8, K6, Z19
- UM West – C2, C8, F8, R3
- UM East – C2, C8; The Bus G
- Riverdale Rd. – 84, 85, F4; The Bus 14

Assumed Ride-On Bus Service to Silver Spring and Bethesda, 2025 Build Scenario

Route	***Route Description***	***Span of Service***	***Headway* (minutes)***	
			Peaks	***Off-Peaks***
1	Friendship Heights Station - Silver Spring Station	5:00 AM - 10:45 PM	30	30
2	Silver Spring Ride-On Operations Center - Silver Spring Station	4:45 AM - 10:45 PM	20	30
3	Takoma Station - Silver Spring Station	7:00 AM - 8:45 AM 5:15 PM - 6:45 PM	30	NA
4	Kensington Station - Silver Spring Station	6:00 AM - 7:00 PM	30	30
5	Twinbrook Station - Silver Spring Station	5:00 AM - 1:00 AM	8	30
8	Wheaton Station - Forest Glen Station - Silver Spring Station	6:00 AM - 8:00 PM	30	30
9	Wheaton Station - Silver Spring Station	5:15 AM - 10:45 PM	15	30
11	Friendship Heights Station - Silver Spring Station	6:00 AM - 10:00 AM 2:00 PM - 7:30 PM	8	NA
12	Takoma Station - Silver Spring Station	4:30 AM - 1:00 PM	10	30
13	Takoma Station - Silver Spring Station	6:30 AM - 9:45 AM 4:15 PM - 7:00 PM	20	NA
14	Takoma Station - Silver Spring Station	5:30 AM - 9:00 PM	25	30
15	Langley Park - Silver Spring Station	4:15 AM - 1:15 AM	4	12
16	Langley Park - Silver Spring Station	4:30 AM - 1:15 AM	12	15
17	Langley Park - Silver Spring Station	4:45 AM - 12:00 AM	15	20
18	Langley Park - Silver Spring Station	5:15 AM - 10:30 PM	7	15
19	Dallas Avenue - Silver Spring Station	6:15 AM - 9:00 AM 4:15 PM - 8:15 PM	30	NA
20	Hillandale - Silver Spring Station	4:15 AM -1:00 AM	7	15
22	Hillandale - Silver Spring Station	6:30 AM - 8:45 AM 3:45 PM - 7:00 PM	30	NA
27	Medical Center Station - Bethesda Station - Friendship Heights Station	7:15 AM - 9:15 AM 4:45 PM - 6:30 PM	30	NA
28	Silver Spring - MARC Shuttle	6:15 AM - 7:15 PM	7.5	7.5
29	Glen Echo - Bethesda Station	6:15 AM - 7:15 PM	30	30
30	Medical Center Station - Bethesda Station	6:00 AM - 9:00 PM	20	30

Table continues, next page

Route	***Route Description***	***Span of Service***	***Headway* (minutes)***	
			Peaks	***Off-Peaks***
32	Naval Ship Research and Development Center - Bethesda Station	6:30 AM - 9:30 AM 3:15 PM - 7:45 PM	30	30
33	Wheaton Station - Medical Center Station	6:00 AM - 9:00 AM 3:15 PM - 7:15 PM	30	NA
34	Aspen Hill - Wheaton Station - Bethesda Station	5:45 AM - 10:15 AM 2:15 PM - 7:45 PM	25	NA
35	Wheaton Station - Medical Center Station - Montgomery mall	5:00 AM - 10:15 PM	25	30
36	Potomac - Bethesda Station	6:30 AM - 8:00 PM	20	30
42	Medical Center - Bethesda Station - Friendship Heights Station	5:15 AM - 12:45 AM	20	30
92	Bethesda 8 Shuttle	7:00 AM - 2:00 AM	8	NA

*Headway is the time between buses on a given route.

Assumed MTA Bus Service to Silver Spring, 2025 Build Scenario

Route	***Route Description***	***Span of Services***	***Headway* (minutes)***	
			Peaks	***Off Peaks***
929	Baltimore - Columbia - Silver Spring Station - Washington	5:00 AM - 8:45 PM	12	limited service
915	Columbia - Silver Spring Station – Washington	5:15 AM - 8:00 PM	8	limited service

*Headway is the time between buses on a given route.

Assumed WMATA Metrobus Service to Silver Spring & Bethesda, 2025 Build Scenario

Route	***Route Description***	***Span of Services***	***Headway* (minutes)***	
			Peaks	***Off-Peaks***
B11	Bethesda Reverse Commute	6:00 AM – 9:45 AM 4:00 PM – 7:45 PM	20	NA
F4,6	New Carrollton Station - Silver Spring Station	5:15 AM - 10:45 PM	15	40
J1,2,3	Silver Spring Station - Montgomery Mall	4:45 AM – 3:00 AM	6	20
J4	College Park – Bethesda	5:45 AM – 9:15 AM 3:30 PM – 7:15 PM	20	20
J5	Twinbrook Station - Silver Spring Station	6:15 AM - 9:30 AM 3:45 PM - 6:45 PM	30	NA
J8-9	1-270 Express	5:45 AM – 9:00 AM 3:00 PM – 7:00 PM	15	20
L7,8	Aspen Hill - Wheaton Station - Friendship Heights Station	5:15 AM - 11:30 PM	8	30
Q2	Shady Grove Station - Silver Spring Station	4:15 AM – 2:45 AM	15	30
S2,4	Silver Spring – Federal Triangle	4:15 AM – 3:00 AM	5	15
Y7,8,9	Rockville Station - Wheaton Station - Silver Spring Station	4:30 AM - 3:15 AM	7	15
Z1,4	Glenmont – Silver Spring	5:00 AM – 9:45 AM 3:00 PM – 9:15 PM	30	NA
Z3,5	Colesville - Fairland - Silver Spring Station	5:30 AM - 8:45 AM 4:00 PM - 8:45 PM	15	NA
Z2	Colesville Road - Silver Spring Station	6:00 AM – 7:45 PM	30	30
Z7,17, 19	Old Columbia Pike - Silver Spring Station	6:15 AM - 9:00 AM 12:15 PM -7:00 PM	30	NA
Z8	Fairland - Silver Spring Station	5:00 AM - 3:00 AM	15 (8)	30
Z11, Z-13	Briggs Chaney Park-and-Ride Lot - Silver Spring Station	5:15 AM – 9:30 AM 3:30 PM – 8:15 PM	10	NA
Z9,29	Burtonsville Park-and-Ride Lot - Silver Spring Station - Laurel	5:15 AM - 10:00 AM 3:15 PM - 7:45 PM	20	NA
14A,B	Old Georgetown Rd/ Bethesda Corridor – Tysons Beltway Express Service	6:30 AM – 10:00 AM 3:15 PM – 7:45 PM	20	30

*Headway is the time between buses on a given route.

Appendix C: Metrorail Service and Headway Comparison (minutes)

Line	***Branch***	***MWCOG Version 2.1C Model Type***			
		2025 CLRP Network		***2030 Bi-County Network***	
		Peaks	***Off-Peaks***	***Peaks***	***Off-Peaks***
Orange	A, Vienna to New Carrollton	4	12	7	12
	B, Dulles/R772 to Stadium/Armory	4	12	7	12
	C, Vienna to Largo	N/A	N/A	14	N/A
Blue	A, Franconia-Springfield to Largo	4	12	14	12
	B, Franconia-Springfield to Greenbelt	N/A	N/A	14	N/A
Red	A, Shady Grove to Glenmont	4	12	2.5	6
	B, Grosvenor to Silver Spring	4	12	N/A	N/A
Yellow	Huntington to Mt. Vernon Square	4	12	7	12
Green	Greenbelt to Branch Ave.	4	12	7	12
	Tripper, Branch Ave. to Greenbelt	N/A	N/A	*	N/A
*4 trains for tripper service					

Appendix D: Comparison between Land Use Forecasts in the Bethesda CBD

	TAZ	*House-holds*	*Popu-lation*	*Employment*				
				Total	*Industrial*	*Retail*	*Office*	*Other*
A. 2025/6.2	343	2,890	7,318	8,376	10	1,607	6,247	512
	344	2,665	6,713	28,984	9	2,059	25,636	1,280
	345	2,100	5,288	10,408	30	2,705	7,255	418
	Total	**7,655**	**19,319**	**47,768**	**49**	**6,371**	**39,138**	**2,210**
B. 2030/6.4A	343	4,786	7,954	7,549	9	1,476	5,422	642
	344	4,648	7,387	26,109	8	1,799	23,167	1,135
	345	3,752	5,753	9,454	24	2,793	6,293	344
	Total	**13,186**	**21,094**	**43,112**	**41**	**6,068**	**34,882**	**2,121**
C. 2005/6.4A	343	2,431	4,027	6,530	9	1,307	4,617	597
	344	2,263	3,706	22,843	8	1,616	20,171	1,048
	345	2,282	3,593	8,369	24	2,454	5,574	317
	Total	**6,976**	**11,326**	**37,742**	**41**	**5,377**	**30,362**	**1,962**
Percent Change (B vs. A)	343	66%	9%	-10%	-10%	-8%	-13%	25%
	344	74%	10%	-10%	-11%	-13%	-10%	-11%
	345	79%	9%	-9%	-20%	3%	-13%	-18%
	Total	**72%**	**9%**	**-10%**	**-16%**	**-5%**	**-11%**	**-4%**
Percent Change (C vs. B)	343	97%	98%	16%	0%	13%	17%	8%
	344	105%	99%	14%	0%	11%	15%	8%
	345	64%	60%	13%	0%	14%	13%	9%
	Total	**89%**	**86%**	**14%**	**0%**	**13%**	**15%**	**8%**

Part I - General Demand

1. 2005 Existing Year

Regional Transit Person Trips (2005)							Rail Trips	
Per Acc.	HBW	HBS	HBO	NHB	Sum	PrdSum		PrdSum
AM Wk	137,077	4,144	30,939	20,321	192,481	292,254	160,952	239,004
AM Dr	87,073	1,375	9,547	87,073	99,773		78,052	
PM Wk	148,681	8,009	37,124	45,019	238,833	351,488	201,023	288,154
PM Dr	94,439	2,695	11,448	94,439	112,655		87,131	
OP Wk	100,424	19,936	86,684	79,885	286,929	391,792	235,132	310,662
OP Dr	63,826	6,876	26,729	63,826	104,863		75,530	
Total	631,520	43,035	202,471	158,508	1,035,534		837,820	

May-04 Rail Trips	
AM	**196,899**
PM	**201,580**
OP	**283,930**
Total	**682,409**

2. 2030 No-Build

Regional Transit Person Trips (2030NB)							Rail Trips	
Per Acc.	HBW	HBS	HBO	NHB	Sum	PrdSum		PrdSum
AM Wk	194,144	5,683	42,983	25,761	268,571	399,198	226,192	329,008
AM Dr	114,898	1,490	11,734	114,898	130,627		102,816	
PM Wk	210,568	10,985	51,563	57,084	330,200	477,638	279,515	394,522
PM Dr	124,625	2,965	14,104	124,625	147,438		115,007	
OP Wk	142,229	27,322	120,343	101,311	391,205	526,141	325,262	422,558
OP Dr	84,182	7,499	32,907	84,182	134,936		97,296	
Total	870,646	55,944	273,634	202,753	1,402,977		1,146,088	

2030NB Adjusted Rail Trips*	
AM	**271,047**
PM	**275,990**
OP	**386,198**
Total	**933,235**

3. 2030 Bi-County Transitway

Regional Transit Person Trips (2030BI)							Rail Trips	
Per Acc.	HBW	HBS	HBO	NHB	Sum	PrdSum		PrdSum
AM Wk	190,593	5,784	43,554	27,063	266,994	403,429	229,360	338,922
AM Dr	120,581	1,674	11,807	120,581	136,435		109,562	
PM Wk	206,685	11,186	52,257	59,955	330,083	483,805	283,907	404,331
PM Dr	130,785	3,296	14,182	130,785	153,722		120,424	
OP Wk	139,594	27,878	121,984	106,392	395,848	535,526	332,189	434,235
OP Dr	88,392	8,312	33,113	88,392	139,678		102,046	
Total	876,630	58,130	276,897	211,103	1,422,760		1,177,488	

2030BI Adjusted Rail Trips**	
AM	**279,215**
PM	**282,852**
OP	**396,870**
Total	**958,937**

* Adjusted = May-04 Observed * (Modeled 2030 NB / 2005)

** Adjusted = 2030 NB Adjusted * (Modeled 2030 BI / 2030 NB)

Part II - Bethesda Station Demand

1. 2005 Existing Year

			Boarding	Alighting
AM Wk	Metro	To CBD	2,186	482
		From CBD	112	2,426
AM Dr	Metro	To CBD	2,013	292
		From CBD	443	644
Total AM	Metro	To CBD	4,199	774
		From CBD	555	3,070
		Total	**4,754**	**3,844**
OP Wk	Metro	To CBD	2,935	511
		From CBD	238	3,280
OP Dr	Metro	To CBD	2,984	361
		From CBD	960	626
Total OP	Metro	To CBD	5,919	872
		From CBD	1,198	3,906
		Total	**7,117**	**4,778**

2. 2030 No-Build

			Boarding	Alighting
AM Wk	Metro	To CBD	4,368	821
		From CBD	250	2,261
AM Dr	Metro	To CBD	2,124	1,045
		From CBD	639	403
Total AM	Metro	To CBD	6,492	1,866
		From CBD	889	2,664
		Total	**7,381**	**4,530**
OP Wk	Metro	To CBD	4,725	426
		From CBD	386	5,096
OP Dr	Metro	To CBD	2,971	88
		From CBD	1,421	578
Total OP	Metro	To CBD	7,696	514
		From CBD	1,807	5,674
		Total	**9,503**	**6,188**

	May-04	
	Boarding	**Alighting**
AM	**3,298**	**2,622**
PM	**2,672**	**3,200**
OP	**3,520**	**3,879**
Total	**9,490**	**9,701**

2030 No-Build (Adjusted)		
	Boarding	**Alighting**
AM*	**5,120**	**3,090**
PM**	**3,149**	**4,968**
OP*	**4,700**	**5,024**
Total	**12,969**	**13,082**

* Adjusted = May-04 Observed * (Modeled 2030 NB / 2005)
** Adjusted Boarding = 2030 NB AM Adjusted Alighting * (May-04 PM Boarding / AM Alighting)
** Adjusted Alighting = 2030 NB AM Adjusted Boarding * (May-04 PM Alighting / AM Boarding)

Part II - Bethesda Station Demand (continued)

3. 2030 Bi-County Transitway

			Boarding	Alighting
AM Wk	LRT	B to N	898	0
		N to B	0	2,156
	Metro	To CBD	4,439	960
		From CBD	572	2,172
AM Dr	LRT	B to N	67	0
		N to B	0	1,066
	Metro	To CBD	2,547	1,048
		From CBD	685	232
Total AM	LRT	B to N	965	0
		N to B	0	3,222
	Metro	To CBD	6,986	2,008
		From CBD	1,257	2,404
		Total	**9,208**	**7,634**
OP Wk	LRT	B to N	2,414	0
		N to B	0	2,444
	Metro	To CBD	4,867	1,023
		From CBD	1,006	4,951
OP Dr	LRT	B to N	178	0
		N to B	0	606
	Metro	To CBD	3,252	210
		From CBD	1,292	450
Total OP	LRT	B to N	2,592	0
		N to B	0	3,050
	Metro	To CBD	8,119	1,233
		From CBD	2,298	5,401
		Total	**13,009**	**9,684**

Transfers between LRT & Metro		
	L to M	M to L
AM Wk	902	453
AM Dr	287	58
Total AM	1,189	511
OP Wk	1,122	1,090
OP Dr	143	172
Total OP	1,265	1,262

Transfers (Adjusted)		
	L to M	M to L
AM^	**819**	**352**
PM^^	**349**	**812**
OP^	**797**	**795**
Total	**1,965**	**1,959**

2030 Bi-County (Adjusted) Access Demand		
	Boarding	**Alighting**
AM^^^	**5,217**	**4,037**
PM^^^	**4,145**	**5,037**
OP^^^	**4,842**	**6,270**
Total	**14,205**	**15,344**

^^^ Adjusted Access Demand = 2030 BI Adjusted - Sum of L to M & M to L Transfers Adusted

^ Adjusted = Modeled 2030 BI * (2030 BI Adjusted Sum of B&A / Modeled 2030 BI Sum of B&A)

^^ Adjusted L to M = Modeled 2030 BI Adjusted AM M to L * (2030 BI Adjusted Sum of B&A PM / AM)

^^ Adjusted M to L = Modeled 2030 BI Adjusted AM L to M * (2030 BI Adjusted Sum of B&A PM / AM)

2030 Bi-County (Adjusted)		
	Boarding	**Alighting**
AM***	**6,388**	**5,207**
PM******	**5,306**	**6,198**
OP***	**6,434**	**7,862**
Total	**18,128**	**19,267**

*** Adjusted = 2030 NB Adjusted * (Modeled 2030 BI / 2030 NB)

**** Adjusted Boarding = 2030 BI AM Adjusted Alighting * (2030 NB PM Boarding / AM Alighting)

**** Adjusted Alighting = 2030 BI AM Adjusted Boarding * (2030 NB PM Alighting / AM Boarding)

Part III - Bethesda Station Local Access Demand

1. 2005 Existing Year

		TAZ/ node	Boarding	Alighting
AM	Wk Access	329	16	6
		332	59	40
		340	97	26
		343	341	298
		344	480	1273
		345	410	581
		351	214	70
	Wk Access	Total	**1617**	**2294**
	Bus Access	3048	**781**	**1648**
	Dr Access	7507	**2454**	**0**
	Total Demand		**4852**	**3942**
OP	Wk Access	329	12	23
		332	76	167
		340	119	173
		343	465	523
		344	1226	1393
		345	795	886
		351	192	235
	Wk Access	Total	**2885**	**3400**
	Bus Access	3048	**357**	**1447**
	Dr Access	7507	**3944**	**0**
	Total Demand		**7186**	**4847**

2. 2030 No-Build

		TAZ/ node	Boarding	Alighting
AM	Wk Access	329	20	11
		332	72	26
		340	119	11
		343	1141	365
		344	1139	1371
		345	1019	834
		351	254	83
	Wk Access	Total	**3764**	**2701**
	Bus Access	3048	**1047**	**2013**
	Dr Access	7507	**2754**	**0**
	Total Demand		**7565**	**4714**
OP	Wk Access	329	14	22
		332	86	178
		340	121	159
		343	970	1106
		344	1892	2132
		345	1419	1551
		351	227	319
	Wk Access	Total	**4729**	**5467**
	Bus Access	3048	**429**	**768**
	Dr Access	7507	**4392**	**0**
	Total Demand		**9550**	**6235**

2030 No-Build (Adjusted)

		TAZ/ node	Boarding	Alighting
AM*	Wk Access	329	14	7
		332	49	17
		340	81	7
		343	772	239
		344	771	899
		345	690	547
		351	172	54
	Wk Access	Total	**2,548**	**1,770**
	Bus Access	3048	**709**	**1,319**
	Dr Access	7507	**1,864**	**0**
	Total Demand		**5,120**	**3,090**
PM**	Wk Access	329	7	13
		332	17	47
		340	7	78
		343	244	749
		344	916	748
		345	557	669
		351	55	167
	Wk Access	Total	**1,804**	**2,472**
	Bus Access	3048	**1,345**	**688**
	Dr Access	7507	**0**	**1,809**
	Total Demand		**3,149**	**4,968**
OP*	Wk Access	329	7	18
		332	42	143
		340	60	128
		343	477	891
		344	931	1,718
		345	698	1,250
		351	112	257
	Wk Access	Total	**2,327**	**4,405**
	Bus Access	3048	**211**	**619**
	Dr Access	7507	**2,162**	**0**
	Total Demand		**4,700**	**5,024**

* Adjusted = 2030 Access Demand * Modeled Access Mode Shares

** Adjusted = 2030 Access Demand * Inversed AM Modeled Access Mode Shares

Part III - Bethesda Station Local Access Demand (continued)

3. 2030 Bi-County Transitway

		TAZ/ node	Boarding	Alighting
AM	Wk Access	329	23	15
		332	70	31
		340	132	33
		343	1182	426
		344	1270	2080
		345	1060	939
		351	418	65
	Wk Access	Total	**4155**	**3589**
	Bus Access	3048	**568**	**2505**
	Dr Access	7507	**2945**	**0**
	Total Demand		**7668**	**6094**
OP	Wk Access	329	33	47
		332	83	196
		340	119	183
		343	1046	1164
		344	2383	2754
		345	1599	1828
		351	281	297
	Wk Access	Total	**5544**	**6469**
	Bus Access	3048	**563**	**714**
	Dr Access	7507	**4401**	**0**
	Total Demand		**10508**	**7183**

2030 Bi-County Transitway (Adjusted)

		TAZ/ node	Boarding	Alighting
AM*	Wk Access	329	16	10
		332	48	21
		340	90	22
		343	804	282
		344	864	1,378
		345	721	622
		351	284	43
	Wk Access	Total	**2,827**	**2,377**
	Bus Access	3048	**386**	**1,659**
	Dr Access	7507	**2,004**	**0**
	Total Demand		**5,217**	**4,037**
PM**	Wk Access	329	10	15
		332	21	46
		340	22	87
		343	290	776
		344	1,415	834
		345	639	696
		351	44	275
	Wk Access	Total	**2,441**	**2,729**
	Bus Access	3048	**1,704**	**373**
	Dr Access	7507	**0**	**1,934**
	Total Demand		**4,145**	**5,037**
OP*	Wk Access	329	15	41
		332	38	171
		340	55	160
		343	482	1,016
		344	1,098	2,404
		345	737	1,596
		351	129	259
	Wk Access	Total	**2,555**	**5,647**
	Bus Access	3048	**259**	**623**
	Dr Access	7507	**2,028**	**0**
	Total Demand		**4,842**	**6,270**

* Adjusted = 2030 Access Demand * Modeled Access Mode Shares

** Adjusted = 2030 Access Demand * Inversed AM Modeled Access Mode Shares

Part IV - Model Version Sensitivity

	Transit Person Trips
1. Version C	
From Bethesda	14,209
To Bethesda	19,597
Total Bethesda Access Trips	33,806
Regional Trips***	1,369,685
2. Version D	
From Bethesda	13,095
To Bethesda	23,077
Total Bethesda Access Trips	36,172
Regional Trips***	1,213,464
3. Adjusted Factors****	
Bethesda Access Trips	**1.07**
Regional Trips	**0.89**

*** Excluding "From & To Bethesda" Trips

**** Adjusted Factors = Version D Transit Trips / Version C Transit Trips

Appendix F: Calculation of Increased Ridership Caused by South Entrance

Block	2030		Avg. dist. to entrance (ft)		Future mode share (pct.)*				Surrogate Ridership									
					N. Entr. only		N. & S. Entr.		N. Entr. only			N. & S. Entr.			Percent Increase			
	Empl.	DU	North	South	Office	Res	Office	Res	Office	Res	Total	Office	Res	Total	Office	Res	Total
1	279	127	1543	2304	14	41	14	41	39	52	91	39	52	91	0%	0%	0%
2	138	4	1924	2684	11	39	11	39	15	2	17	15	2	17	0%	0%	0%
3	162	7	2254	3018	9	37	9	37	14	3	17	14	3	17	0%	0%	0%
5	73	175	2510	3275	7	35	7	35	5	61	66	5	61	66	0%	0%	0%
6	56	16	2748	3514	5	33	5	33	3	5	8	3	5	8	0%	0%	0%
7	28	7	3072	3839	3	31	3	31	1	2	3	1	2	3	0%	0%	0%
8	414	127	3167	3951	2	31	2	31	8	39	47	8	39	47	0%	0%	0%
9	1229	245	2633	3418	6	34	6	34	72	84	155	72	84	155	0%	0%	0%
10	480	234	1943	2731	11	39	11	39	53	91	143	53	91	143	0%	0%	0%
11	203	0	1470	2257	14	42	14	42	29	0	29	29	0	29	0%		0%
12	1159	0	1708	2497	13	40	13	40	147	0	147	147	0	147	0%		0%
12	1159	0	1478	2268	14	42	14	42	167	0	167	167	0	167	0%		0%
13	486	103	2026	2814	10	38	10	38	50	39	90	50	39	90	0%	0%	0%
14	170	574	2248	3035	9	37	9	37	15	210	225	15	210	225	0%	0%	0%
15	318	56	2417	3198	7	36	7	36	24	20	44	24	20	44	0%	0%	0%
16	1337	691	2788	3576	5	33	5	33	63	229	292	63	229	292	0%	0%	0%
17	0	837	3370	4155	0	29	0	29	0	245	245	0	245	245		0%	0%
18	0	89	3431	4148	0	29	0	29	0	26	26	0	26	26		0%	0%
19	0	264	3073	3818	3	31	3	31	0	82	82	0	82	82		0%	0%
20	655	15	2597	3328	6	34	6	34	40	5	45	40	5	45	0%	0%	0%
21	286	0	2308	3045	8	36	8	36	24	0	24	24	0	24	0%		0%
22	497	0	2033	2777	10	38	10	38	51	0	51	51	0	51	0%		0%
23	927	0	1755	2506	12	40	12	40	114	0	114	114	0	114	0%		0%
25	207	0	1948	2635	11	39	11	39	23	0	23	23	0	23	0%		0%
34	0	0	1178	1065	17	44	17	44	0	0	0	0	0	0			
35	0	0	1709	2324	13	40	13	40	0	0	0	0	0	0			
36	0	2	1554	2044	14	41	14	41	0	1	1	0	1	1		0%	0%
37	0	0	1388	1694	15	42	15	42	0	0	0	0	0	0			
38	0	0	1640	1677	13	41	13	41	0	0	0	0	0	0			
40	667	155	1040	1090	18	45	18	45	118	69	187	118	69	187	0%	0%	0%
41	188	537	883	1218	19	46	19	46	35	245	281	35	245	281	0%	0%	0%
42	167	591	958	1559	18	45	18	45	30	267	297	30	267	297	0%	0%	0%
43	812	0	1243	1936	16	43	16	43	131	0	131	131	0	131	0%		0%
44	1112	21	1507	2267	14	42	14	42	158	9	166	158	9	166	0%	0%	0%
45	448	264	1135	1907	17	44	17	44	76	116	192	76	116	192	0%	0%	0%
46	3868	0	820	1610	19	46	19	46	745	0	745	745	0	745	0%		0%
47	866	0	289	1076	23	50	23	50	201	0	201	201	0	201	0%		0%
48	252	312	593	1289	21	48	21	48	53	148	201	53	148	201	0%	0%	0%
49	4478	0	198	818	24	50	24	50	1069	0	1069	1069	0	1069	0%		0%

	2030		Avg. dist. to entrance (ft)		Future mode share (pct.)*				Surrogate Ridership								
					N. Entr. only		N. & S. Entr.		N. Entr. only			N. & S. Entr.			Percent Increase		
Block	Empl.	DU	North	South	Office	Res	Office	Res	Office	Res	Total	Office	Res	Total	Office	Res	Total
50	0	0	491	708	22	48	22	48	0	0	0	0	0	0			
51	0	37	682	603	20	47	21	48	0	17	17	0	18	18		1%	1%
52	1163	1	820	336	19	46	23	49	224	0	224	266	0	266	19%	7%	19%
53	1040	0	590	269	21	48	23	50	218	0	218	243	0	243	11%		11%
54	935	0	668	285	20	47	23	50	191	0	191	217	0	217	14%		14%
55	1401	0	358	600	23	49	23	49	318	0	318	318	0	318	0%		0%
56	3315	204	509	1020	22	48	22	48	715	98	813	715	98	813	0%	0%	0%
57	183	59	743	1358	20	47	20	47	36	27	64	36	27	64	0%	0%	0%
58	1235	263	1013	1763	18	45	18	45	220	118	338	220	118	338	0%	0%	0%
59	0	27	1103	1719	17	44	17	44	0	12	12	0	12	12		0%	0%
60	566	67	1530	1803	14	41	14	41	79	28	107	79	28	107	0%	0%	0%
62	3074	370	1530	1508	14	41	14	42	431	153	584	436	154	589	1%	0%	1%
63	2000	0	1830	1695	12	39	13	40	236	0	236	256	0	256	8%		8%
64	1359	0	772	824	20	46	20	46	267	0	267	267	0	267	0%		0%
65	1257	198	1036	608	18	45	21	47	222	88	310	262	94	356	18%	6%	15%
70	0	0	1325	660	16	43	20	47	0	0	0	0	0	0			
71	885	3	1237	481	16	43	22	48	143	1	144	193	1	194	35%	12%	34%
72	1020	0	1649	880	13	41	19	46	134	0	134	192	0	192	43%		43%
73	100	2	2035	1255	10	38	16	43	10	1	11	16	1	17	56%	14%	53%
74	272	22	2364	1583	8	36	14	41	21	8	29	37	9	46	74%	14%	58%
75	293	16	2778	1994	5	33	11	38	14	5	19	31	6	37	122%	16%	92%
76	763	157	2328	1539	8	36	14	41	62	57	119	106	65	171	72%	14%	45%
77	26	209	1664	886	13	41	19	46	3	85	88	5	95	100	44%	13%	14%
78	76	257	1436	669	15	42	20	47	11	108	119	15	121	136	39%	12%	15%
79	2456	0	1108	398	17	44	22	49	421	0	421	550	0	550	31%		31%
80	1510	180	1385	1049	15	42	18	45	228	76	304	265	80	346	16%	5%	14%
81	374	63	1883	1748	11	39	12	40	43	25	67	46	25	72	9%	2%	6%
82	507	306	2494	2175	7	35	9	37	35	107	142	47	114	160	34%	6%	13%
83	1760	105	2019	1563	10	38	14	41	183	40	223	242	43	285	32%	8%	28%
84	33	121	1840	1248	12	39	16	43	4	48	51	5	52	58	37%	10%	12%
85	0	70	1973	1294	11	38	16	43	0	27	27	0	30	30		12%	12%
86	0	179	2247	1497	9	37	14	42	0	66	66	0	74	74		13%	13%
87	0	369	2636	1876	6	34	11	39	0	126	126	0	144	144		15%	15%
88	33	291	2971	2253	3	32	9	37	1	93	94	3	107	109	159%	15%	17%
89	0	88	2612	1955	6	34	11	39	0	30	30	0	34	34		13%	13%
90	0	110	3131	2570	2	31	6	35	0	34	34	0	38	38		12%	12%
91	106	102	3331	2872	1	30	4	33	1	30	31	4	33	38	500%	10%	22%
Weighted Average															**7.5%**	**3.2%**	**6.2%**

* Source: WMATA Development-Related Ridership Survey, 1987, 1989

Appendix G: Ridership Adjustments to Account for South Entrance

Walk Access Trip Adjustment Factors	
AM Boarding	1.032
PM Alighting	1.032
AM Alighting	1.075
PM Boarding	1.075
Daily	1.062

Option 2: South Entrance Only

			Boarding	Alighting
AM Wk	Metro	To CBD	4,508	847
		From CBD	258	2,333
AM Dr	Metro	To CBD	2,124	1,045
		From CBD	639	403
Total AM	Metro	To CBD	6,632	1,892
		From CBD	897	2,736
		Total	**7,529**	**4,629**
OP Wk	Metro	To CBD	5,018	452
		From CBD	410	5,412
OP Dr	Metro	To CBD	2,971	88
		From CBD	1,421	578
Total OP	Metro	To CBD	7,989	540
		From CBD	1,831	5,990
		Total	**9,820**	**6,530**

2030 South Only (Adjusted)		
	Boardin	**Alighting**
AM	**5,223**	**3,157**
PM	**3,217**	**5,068**
OP	**4,857**	**5,302**
Total	**13,297**	**13,527**

Option 3 adjusted to account for south entrance

Part A: Trips subject to increasing

			Boarding	Alighting
AM Wk	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	3,537	960
		From CBD	572	1,719
AM Dr	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	0	0
		From CBD	0	0
Total AM	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	3,537	960
		From CBD	572	1,719
		Total	**4,109**	**2,679**
OP Wk	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	3,745	1,023
		From CBD	1,006	3,861
OP Dr	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	0	0
		From CBD	0	0
Total OP	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	3,745	1,023
		From CBD	1,006	3,861
		Total	**4,751**	**4,884**

Option 3 adjusted to account for south entrance (continued)

Part B: Increase in trips due to south entrance

			Boarding	Alighting
AM Wk	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	113	72
		From CBD	18	129
AM Dr	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	0	0
		From CBD	0	0
Total AM	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	113	72
		From CBD	18	129
		Total	**131**	**201**
OP Wk	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	232	63
		From CBD	62	239
OP Dr	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	0	0
		From CBD	0	0
Total OP	LRT	B to N	0	0
		N to B	0	0
	Metro	To CBD	232	63
		From CBD	62	239
		Total	**295**	**303**

Part C: New total trips, adjusted for south entrance

			Boarding	Alighting
AM Wk	LRT	B to N	898	0
		N to B	0	2,156
	Metro	To CBD	4,552	1,032
		From CBD	590	2,301
AM Dr	LRT	B to N	67	0
		N to B	0	1,066
	Metro	To CBD	2,547	1,048
		From CBD	685	232
Total AM	LRT	B to N	965	0
		N to B	0	3,222
	Metro	To CBD	7,099	2,080
		From CBD	1,275	2,533
		Total	**9,339**	**7,835**
OP Wk	LRT	B to N	2414	0
		N to B	0	2,444
	Metro	To CBD	5,099	1,086
		From CBD	1,068	5,190
OP Dr	LRT	B to N	178	0
		N to B	0	606
	Metro	To CBD	3,252	210
		From CBD	1,292	450
Total OP	LRT	B to N	2,592	0
		N to B	0	3,050
	Metro	To CBD	8,351	1,296
		From CBD	2,360	5,640
		Total	**13,304**	**9,987**

Part D: New total trips, excluding transfers

			Boarding	Alighting
AM Wk	LRT	B to N	445	0
		N to B	0	1,254
	Metro	To CBD	3,650	1,032
		From CBD	590	1,848
AM Dr	LRT	B to N	9	0
		N to B	0	779
	Metro	To CBD	2,260	1,048
		From CBD	685	174
Total AM	LRT	B to N	454	0
		N to B	0	2,033
	Metro	To CBD	5,910	2,080
		From CBD	1,275	2,022
		Total	**7,639**	**6,135**
OP Wk	LRT	B to N	1,324	0
		N to B	0	1,322
	Metro	To CBD	3,977	1,086
		From CBD	1,068	4,100
OP Dr	LRT	B to N	6	0
		N to B	0	463
	Metro	To CBD	3,109	210
		From CBD	1,292	278
Total OP	LRT	B to N	1,330	0
		N to B	0	1,785
	Metro	To CBD	7,086	1,296
		From CBD	2,360	4,378
		Total	**10,777**	**7,460**

Option 3 adjusted to account for south entrance (continued)

2030 Bi-County (Adjusted)		
	Boarding	Alighting
AM	6,479	5,344
PM	5,446	6,287
OP	6,580	8,108
Total	18,505	19,739

Transfers (Adjusted)		
	L to M	M to L
AM	819	352
PM	349	812
OP	798	796
Total	1,965	1,960

2030 Bi-County (Adjusted) Access Demand		
	Boarding	Alighting
AM	5,309	4,174
PM	4,285	5,125
OP	4,986	6,514
Total	14,580	15,813

Access Demand by Mode (excludes transfers)					
Boarding			Alighting		
M	L	Both	M	L	Both
4,993	315	5,309	2,791	1,383	4,174
2,865	1,420	4,285	4,821	305	5,125
4,371	615	4,986	4,955	1,559	6,514
12,229	2,351	14,580	12,567	3,246	15,813

2030 No-Build (Adjusted)

			Entrance Use Ratios					Trips by Entrance					
		TAZ/	Boardings		Alightings			Boardings			Alightings		
		Node	North	South	North	South		North	South	Total	North	South	Total
AM	Wk Access	329	0%	100%	0%	100%		0	14	14	0	7	7
		332	30%	70%	30%	70%		15	34	49	5	12	17
		340	50%	50%	50%	50%		40	40	81	4	4	7
		343	100%	0%	100%	0%		772	0	772	239	0	239
		344	87%	13%	77%	23%		671	100	771	692	207	899
		345	0%	100%	0%	100%		0	690	690	0	547	547
		351	100%	0%	100%	0%		172	0	172	54	0	54
	Wk Access	Total						**1,670**	**878**	**2,548**	**994**	**776**	**1,770**
	Bus Access	3048	90%	10%	90%	10%		638	71	**709**	1,188	132	**1,319**
	Dr Access	7507	70%	30%	70%	30%		1,305	559	**1,864**	0	0	**0**
	Total Demand							**3,612**	**1,508**	**5,120**	**2,182**	**908**	**3,090**
PM	Wk Access	329	0%	100%	0%	100%		0	7	7	0	13	13
		332	30%	70%	30%	70%		5	12	17	14	33	47
		340	50%	50%	50%	50%		4	4	7	39	39	78
		343	100%	0%	100%	0%		244	0	244	749	0	749
		344	77%	23%	87%	13%		705	211	916	651	97	748
		345	0%	100%	0%	100%		0	557	557	0	669	669
		351	100%	0%	100%	0%		55	0	55	167	0	167
	Wk Access	Total						**1,013**	**791**	**1,804**	**1,620**	**852**	**2,472**
	Bus Access	3048	90%	10%	90%	10%		1,210	134	**1,345**	619	69	**688**
	Dr Access	7507	70%	30%	70%	30%		0	0	**0**	1,266	543	**1,809**
	Total Demand							**2,223**	**925**	**3,149**	**3,505**	**1,463**	**4,968**
OP	Wk Access	329	0%	100%	0%	100%		0	7	7	0	18	18
		332	30%	70%	30%	70%		13	30	42	43	100	143
		340	50%	50%	50%	50%		30	30	60	64	64	128
		343	100%	0%	100%	0%		477	0	477	891	0	891
		344	82%	18%	82%	18%		764	168	931	1,409	309	1,718
		345	0%	100%	0%	100%		0	698	698	0	1,250	1,250
		351	100%	0%	100%	0%		112	0	112	257	0	257
	Wk Access	Total						**1,395**	**932**	**2,327**	**2,664**	**1,741**	**4,405**
	Bus Access	3048	90%	10%	90%	10%		190	21	**211**	557	62	**619**
	Dr Access	7507	70%	30%	70%	30%		1,513	648	**2,162**	0	0	**0**
	Total Demand							**3,098**	**1,602**	**4,700**	**3,221**	**1,803**	**5,024**

2030 Bi-County Transitway (Adjusted)

			Entrance Use Ratios					Trips by Entrance					
		TAZ/	Boardings		Alightings			Boardings			Alightings		
		Node	North	South	North	South		North	South	Total	North	South	Total
AM	Wk Access	329	0%	100%	0%	100%		0	16	16	0	10	10
		332	30%	70%	30%	70%		14	33	48	6	14	21
		340	50%	50%	50%	50%		45	45	90	11	11	22
		343	100%	0%	100%	0%		804	0	804	282	0	282
		344	87%	13%	77%	23%		752	112	864	1,061	317	1,378
		345	0%	100%	0%	100%		0	721	721	0	622	622
		351	100%	0%	100%	0%		284	0	284	43	0	43
	Wk Access	Total						**1,900**	**927**	**2,827**	**1,403**	**974**	**2,377**
	Bus Access	3048	90%	10%	90%	10%		348	39	**386**	1,493	166	**1,659**
	Dr Access	7507	70%	30%	70%	30%		1,403	601	**2,004**	0	0	**0**
	Total Demand							**3,650**	**1,567**	**5,217**	**2,897**	**1,140**	**4,037**
PM	Wk Access	329	0%	100%	0%	100%		0	10	10	0	15	15
		332	30%	70%	30%	70%		6	15	21	14	32	46
		340	50%	50%	50%	50%		11	11	22	43	43	87
		343	100%	0%	100%	0%		290	0	290	776	0	776
		344	77%	23%	87%	13%		1,089	325	1,415	726	108	834
		345	0%	100%	0%	100%		0	639	639	0	696	696
		351	100%	0%	100%	0%		44	0	44	275	0	275
	Wk Access	Total						**1,441**	**1,000**	**2,441**	**1,834**	**895**	**2,729**
	Bus Access	3048	90%	10%	90%	10%		1,534	170	**1,704**	336	37	**373**
	Dr Access	7507	70%	30%	70%	30%		0	0	**0**	1,354	580	**1,934**
	Total Demand							**2,975**	**1,171**	**4,145**	**3,524**	**1,513**	**5,037**
OP	Wk Access	329	0%	100%	0%	100%		0	15	15	0	41	41
		332	30%	70%	30%	70%		11	27	38	51	120	171
		340	50%	50%	50%	50%		27	27	55	80	80	160
		343	100%	0%	100%	0%		482	0	482	1,016	0	1,016
		344	82%	18%	82%	18%		900	198	1,098	1,971	433	2,404
		345	0%	100%	0%	100%		0	737	737	0	1,596	1,596
		351	100%	0%	100%	0%		129	0	129	259	0	259
	Wk Access	Total						**1,551**	**1,004**	**2,555**	**3,378**	**2,269**	**5,647**
	Bus Access	3048	90%	10%	90%	10%		233	26	**259**	561	62	**623**
	Dr Access	7507	70%	30%	70%	30%		1,420	608	**2,028**	0	0	**0**
	Total Demand							**3,204**	**1,638**	**4,842**	**3,939**	**2,331**	**6,270**

2030 Bi-County Transitway (Adjusted) (continued)

			Access Point Use Ratios (for South Trips)				Boardings			Alightings		
		TAZ/	Boardings		Alightings		West	East	Total	West	East	Total
		Node	West	East (elev)	West	East (elev)						
AM	Wk Access	329	100%	0%	100%	0%	16	0	16	10	0	10
		332	0%	100%	0%	100%	0	33	33	0	14	14
		340	50%	50%	50%	50%	22	22	45	5	5	11
		343	0%	100%	0%	100%	0	0	0	0	0	0
		344	0%	100%	0%	100%	0	112	112	0	317	317
		345	89%	11%	44%	56%	642	79	721	274	348	622
		351	0%	100%	0%	100%	0	0	0	0	0	0
	Wk Access	Total					**680**	**247**	**927**	**289**	**685**	**974**
	Bus Access	3048	0%	100%	0%	100%	0	39	**39**	0	166	**166**
	Dr Access	7507	2%	98%	2%	98%	12	589	**601**	0	0	**0**
	Total Demand						**692**	**875**	**1,567**	**289**	**851**	**1,140**
PM	Wk Access	329	100%	0%	100%	0%	10	0	10	15	0	15
		332	0%	100%	0%	100%	0	15	15	0	32	32
		340	50%	50%	50%	50%	6	6	11	22	22	43
		343	0%	100%	0%	100%	0	0	0	0	0	0
		344	0%	100%	0%	100%	0	325	325	0	108	108
		345	44%	56%	89%	11%	281	358	639	620	77	696
		351	0%	100%	0%	100%	0	0	0	0	0	0
	Wk Access	Total					**297**	**703**	**1,000**	**656**	**239**	**895**
	Bus Access	3048	0%	100%	0%	100%	0	170	**170**	0	37	**37**
	Dr Access	7507	2%	98%	2%	98%	0	0	**0**	12	569	**580**
	Total Demand						**297**	**874**	**1,171**	**668**	**845**	**1,513**
OP	Wk Access	329	100%	0%	100%	0%	15	0	15	41	0	41
		332	0%	100%	0%	100%	0	27	27	0	120	120
		340	50%	50%	50%	50%	14	14	27	40	40	80
		343	0%	100%	0%	100%	0	0	0	0	0	0
		344	0%	100%	0%	100%	0	198	198	0	433	433
		345	67%	34%	67%	34%	490	247	737	1,061	535	1,596
		351	0%	100%	0%	100%	0	0	0	0	0	0
	Wk Access	Total					**519**	**485**	**1,004**	**1,142**	**1,127**	**2,269**
	Bus Access	3048	0%	100%	0%	100%	0	26	**26**	0	62	**62**
	Dr Access	7507	2%	98%	2%	98%	12	596	**608**	0	0	**0**
	Total Demand						**531**	**1,107**	**1,638**	**1,142**	**1,189**	**2,331**

Appendix H: South Entrance Elevator Analysis

Bethesda South Entrance Elevator Analysis

Time Period	AM Peak
Option	2: South Entrance
No. of cabs required	**3**

Passenger Forecast	3 hr peak South Ent.	30 min peak South Ent.	Access via trail		Adjusted forecast
			Bi-County	Metro	
		0.2453			
From Street to Metro	1611.0	395.2		0.0	395.2
From Street to Bi-County	0.0	0.0	0.0		0.0
From Bi-County to Metro	0.0	0.0			0.0
From Bi-County to Street	0.0	0.0	0.0		0.0
From Metro to Bi-County	0.0	0.0			0.0
From Metro to Street	975.0	239.2		0.0	306.1

Trail Access Proportion	
Boardings	0
Alightings	0

Peaking factor for alighting passengers	1.28

Elevator Cycle Analysis

Passengers in peak 30 min	Passengers per cab	Passengers per cab per cycle	Event	Rise (ft)	Time (sec)	Cumulative time (sec)	Passenger load
395.2	131.7	6.2	Passengers enter at street level		6.2	6.2	6.2
			Doors close		3.1	9.3	6.2
			Travel to Bi-County level	24.5	8.2	17.5	6.2
			Doors open		0.0	17.5	6.2
0.0	0.0	0.0	Passengers exit at Bi-County level		0.0	17.5	6.2
0.0	0.0	0.0	Passengers enter at Bi-County level		0.0	17.5	6.2
			Doors close		0.0	17.5	6.2
			Travel to Metro level	98	16.8	34.3	6.2
			Doors open		3.1	37.4	6.2
395.2	131.7	6.2	Passengers exit at Metro level		6.2	43.6	0.0
306.1	102.0	4.8	Passengers enter at Metro level		4.8	48.3	4.8
			Doors close		3.1	51.5	4.8
			Travel to Bi-County level	98	16.8	68.3	4.8
			Doors open		0.0	68.3	4.8
0.0	0.0	0.0	Passengers exit at Bi-County level		0.0	68.3	4.8
0.0	0.0	0.0	Passengers enter at Bi-County level		0.0	68.3	4.8
			Doors close		0.0	68.3	4.8
			Travel to street level	24.5	8.2	76.5	4.8
			Doors open		3.1	79.6	4.8
306.1	102.0	4.8	Passengers exit at street level		4.8	84.3	0.0
			TOTAL CYCLE TIME			84.3	
			PEAK PASSENGER LOAD				6.2

Input	
Cab accel & decel time	2 sec
Cab speed	350 ft/min
Cab passenger capacity	9.6
Time per passenger to load/ unload	1 sec
Door cycle time	6.22 sec

Elevator Travel Times (sec)	
Average cab arrival interval	28.1
From Street to Metro	43.6
From Street to Bi-County	17.5
From Bi-County to Metro	26.1
From Bi-County to Street	16.1
From Metro to Bi-County	24.7
From Metro to Street	40.8

Bethesda South Entrance Elevator Analysis

Time Period	PM Peak
Option	2: South Entrance
No. of cabs required	**3**

Passenger Forecast	3 hr peak South Ent.	30 min peak South Ent.	Access via trail		Adjusted forecast
			Bi-County	Metro	
		0.2103			
From Street to Metro	993.0	208.8		0.0	208.8
From Street to Bi-County	0.0	0.0	0.0		0.0
From Bi-County to Metro	0.0	0.0			0.0
From Bi-County to Street	0.0	0.0	0.0		0.0
From Metro to Bi-County	0.0	0.0			0.0
From Metro to Street	1563.0	328.7		0.0	420.7

Trail Access Proportion	
Boardings	0
Alightings	0

Peaking factor for alighting passengers	1.28

Elevator Cycle Analysis

Passengers in peak 30 min	Passengers per cab	Passengers per cab per cycle	Event	Rise (ft)	Time (sec)	Cumulative time (sec)	Passenger load
208.8	69.6	3.1	Passengers enter at street level		3.1	3.1	3.1
			Doors close		3.1	6.3	3.1
			Travel to Bi-County level	24.5	8.2	14.5	3.1
			Doors open		0.0	14.5	3.1
0.0	0.0	0.0	Passengers exit at Bi-County level		0.0	14.5	3.1
0.0	0.0	0.0	Passengers enter at Bi-County level		0.0	14.5	3.1
			Doors close		0.0	14.5	3.1
			Travel to Metro level	98	16.8	31.3	3.1
			Doors open		3.1	34.4	3.1
208.8	69.6	3.1	Passengers exit at Metro level		3.1	37.5	0.0
420.7	140.2	6.3	Passengers enter at Metro level		6.3	43.9	6.3
			Doors close		3.1	47.0	6.3
			Travel to Bi-County level	98	16.8	63.8	6.3
			Doors open		0.0	63.8	6.3
0.0	0.0	0.0	Passengers exit at Bi-County level		0.0	63.8	6.3
0.0	0.0	0.0	Passengers enter at Bi-County level		0.0	63.8	6.3
			Doors close		0.0	63.8	6.3
			Travel to street level	24.5	8.2	72.0	6.3
			Doors open		3.1	75.1	6.3
420.7	140.2	6.3	Passengers exit at street level		6.3	81.4	0.0
			TOTAL CYCLE TIME			81.4	
			PEAK PASSENGER LOAD				6.3

Input	
Cab accel & decel time	2 sec
Cab speed	350 ft/min
Cab passenger capacity	9.6
Time per passenger to load/ unload	1 sec
Door cycle time	6.22 sec

Elevator Travel Times (sec)	
Average cab arrival interval	27.1
From Street to Metro	37.5
From Street to Bi-County	14.5
From Bi-County to Metro	23.1
From Bi-County to Street	17.7
From Metro to Bi-County	26.3
From Metro to Street	43.9

Bethesda South Entrance Elevator Analysis

Time Period	AM Peak
Option	3: Bi-County Transitway
No. of cabs required	**5**

Passenger Forecast	3 hr peak South Ent.	30 min peak South Ent.	Access via trail		Adjusted forecast
			Bi-County	Metro	
		0.2453			
From Street to Metro	1540.0	377.8		167.0	210.8
From Street to Bi-County	315.0	77.3	34.2		43.1
From Bi-County to Metro	819.0	200.9			424.1
From Bi-County to Street	1383.0	339.2	86.2		323.9
From Metro to Bi-County	352.0	86.3			179.3
From Metro to Street	862.0	211.4		53.7	201.9

Trail Access Proportion	
Boardings	0.442
Alightings	0.254

Peaking factor for alighting passengers	1.28

Elevator Cycle Analysis

Passengers in peak 30 min	Passengers per cab	Passengers per cab per cycle	Event	Rise (ft)	Time (sec)	Cumulative time (sec)	Passenger load
253.9	50.8	3.4	Passengers enter at street level		3.4	3.4	3.4
			Doors close		3.1	6.5	3.4
			Travel to Bi-County level	24.5	8.2	14.7	3.4
			Doors open		3.1	17.8	3.4
43.1	8.6	0.6	Passengers exit at Bi-County level		0.6	18.4	2.8
424.1	84.8	5.6	Passengers enter at Bi-County level		5.6	24.0	8.4
			Doors close		3.1	27.1	8.4
			Travel to Metro level	98	20.8	47.9	8.4
			Doors open		3.1	51.0	8.4
634.9	127.0	8.4	Passengers exit at Metro level		8.4	59.5	0.0
381.2	76.2	5.1	Passengers enter at Metro level		5.1	64.5	5.1
			Doors close		3.1	67.6	5.1
			Travel to Bi-County level	98	20.8	88.4	5.1
			Doors open		3.1	91.6	5.1
179.3	35.9	2.4	Passengers exit at Bi-County level		2.4	93.9	2.7
323.9	64.8	4.3	Passengers enter at Bi-County level		4.3	98.2	7.0
			Doors close		3.1	101.4	7.0
			Travel to street level	24.5	8.2	109.6	7.0
			Doors open		3.1	112.7	7.0
525.9	105.2	7.0	Passengers exit at street level		7.0	119.7	0.0
			TOTAL CYCLE TIME			119.7	
			PEAK PASSENGER LOAD				8.4

Input	
Cab accel & decel time	2 sec
Cab speed	350 ft/min
Cab passenger capacity	9.6
Time per passenger to load/ unload	1 sec
Door cycle time	6.22 sec

Elevator Travel Times (sec)	
Average cab arrival interval	23.9
From Street to Metro	59.5
From Street to Bi-County	18.4
From Bi-County to Metro	41.1
From Bi-County to Street	25.7
From Metro to Bi-County	34.5
From Metro to Street	60.2

Bethesda South Entrance Elevator Analysis

Time Period	PM Peak
Option	3: Bi-County Transitway
No. of cabs required	**5**

Passenger Forecast	3 hr peak South Ent.	30 min peak South Ent.	Access via trail		Adjusted forecast
			Bi-County	Metro	
		0.2103			
From Street to Metro	885.0	186.1		47.3	138.8
From Street to Bi-County	1420.0	298.6	75.9		222.8
From Bi-County to Metro	349.0	73.4			141.2
From Bi-County to Street	305.0	64.1	28.4		45.8
From Metro to Bi-County	812.0	170.8			395.5
From Metro to Street	1487.0	312.7		138.2	223.4

Trail Access Proportion	
Boardings	0.254
Alightings	0.442

Peaking factor for alighting passengers	1.28

Elevator Cycle Analysis

Passengers in peak 30 min	Passengers per cab	Passengers per cab per cycle	Event	Rise (ft)	Time (sec)	Cumulative time (sec)	Passenger load
361.6	72.3	4.5	Passengers enter at street level		4.5	4.5	4.5
			Doors close		3.1	7.6	4.5
			Travel to Bi-County level	24.5	8.2	15.8	4.5
			Doors open		3.1	18.9	4.5
222.8	44.6	2.8	Passengers exit at Bi-County level		2.8	21.7	1.7
141.2	28.2	1.8	Passengers enter at Bi-County level		1.8	23.4	3.5
			Doors close		3.1	26.6	3.5
			Travel to Metro level	98	20.8	47.4	3.5
			Doors open		3.1	50.5	3.5
280.1	56.0	3.5	Passengers exit at Metro level		3.5	53.9	0.0
618.9	123.8	7.7	Passengers enter at Metro level		7.7	61.6	7.7
			Doors close		3.1	64.8	7.7
			Travel to Bi-County level	98	20.8	85.6	7.7
			Doors open		3.1	88.7	7.7
395.5	79.1	4.9	Passengers exit at Bi-County level		4.9	93.6	2.8
45.8	9.2	0.6	Passengers enter at Bi-County level		0.6	94.1	3.3
			Doors close		3.1	97.3	3.3
			Travel to street level	24.5	8.2	105.5	3.3
			Doors open		3.1	108.6	3.3
269.2	53.8	3.3	Passengers exit at street level		3.3	111.9	0.0
			TOTAL CYCLE TIME			111.9	
			PEAK PASSENGER LOAD				7.7

Input	
Cab accel & decel time	2 sec
Cab speed	350 ft/min
Cab passenger capacity	9.6
Time per passenger to load/ unload	1 sec
Door cycle time	6.22 sec

Elevator Travel Times (sec)	
Average cab arrival interval	22.4
From Street to Metro	53.9
From Street to Bi-County	21.7
From Bi-County to Metro	32.3
From Bi-County to Street	18.3
From Metro to Bi-County	39.6
From Metro to Street	58.0

Appendix I: Metrorail Station Infrastructure Analysis

Bethesda Metrorail Station Infrastructure Analysis

Input			
A	Peaking factor for alighting passengers	1.28	
B	Escalator flow rate	83 ppm	
C	Stair flow rate	55 ppm	
D	30 min peak factor	AM: 0.2453	PM: 0.2103
E	Fare gate aisle flow rate	32 ppm	
F	Passengers using farecard vendor	30 %	
G	Farecard vendor flow rate	2.5 transactions per min	
H	Farecard vendor peaking factor	1.1	

Scenario Analyzed	
Option	1: No-Build
Entrance	North

Infrastructure Analysis									
		AM			PM			Critical	
		Alighting	Boarding	Total	Alighting	Boarding	Total		
K	Passengers, 3-hr peak	3090	5120	8210	4968	3149	8117		
L	Passengers, 30-min peak	758	1256	2014	1045	662	1707		**K** x **D**
M	Boarding passengers per minute		41.86			22.07			**L** / 30
	Alighting passengers per minute	64.68			89.15				**A** x 2**L** / 30
P	Platform Escalators Required	0.78	0.50	2	1.07	0.27	3	**3**	**M** / **B**
Q	Farecard Vendors Required		6.08	7		3.21	4	**7**	**M** x **F** x **G** x **H** + 10%
R	Fare Gate Aisles Required	2.02	1.31	5	2.79	0.69	4	**5**	**M** / **E**
S	ADA-Accessible Fare Gate Aisles Required	1	1	2	1	1	2	**2**	
T	Total Fare Gate Aisles Required			8			7	**8**	**R** + **S** + 10%

Bethesda Metrorail Station Infrastructure Analysis

Input			
A	Peaking factor for alighting passengers	1.28	
B	Escalator flow rate	83 ppm	
C	Stair flow rate	55 ppm	
D	30 min peak factor	AM: 0.2453	PM: 0.2103
E	Fare gate aisle flow rate	32 ppm	
F	Passengers using farecard vendor	30 %	
G	Farecard vendor flow rate	2.5 transactions per min	
H	Farecard vendor peaking factor	1.1	

Scenario Analyzed	
Option	2: South Entrance
Entrance	North

Infrastructure Analysis									
		AM			PM			Critical	
		Alighting	Boarding	Total	Alighting	Boarding	Total		
K	Passengers, 3-hr peak	2182	3612	5794	3505	2224	5729		
L	Passengers, 30-min peak	535	886	1421	737	468	1205		**K** x **D**
M	Boarding passengers per minute		29.53			15.59			**L** / 30
	Alighting passengers per minute	45.67			62.90				**A** x 2**L** / 30
P	Platform Escalators Required	0.55	0.36	2	0.76	0.19	2	**2**	**M** / **B**
Q	Farecard Vendors Required		4.29	5		2.26	3	**5**	**M** x **F** x **G** x **H** + 10%
R	Fare Gate Aisles Required	1.43	0.92	3	1.97	0.49	3	**3**	**M** / **E**
S	ADA-Accessible Fare Gate Aisles Required	1	1	2	1	1	2	**2**	
T	Total Fare Gate Aisles Required			6			6	**6**	**R** + **S** + 10%

Bethesda Metrorail Station Infrastructure Analysis

Input			
A	Peaking factor for alighting passengers	1.28	
B	Escalator flow rate	83 ppm	
C	Stair flow rate	55 ppm	
D	30 min peak factor	AM: 0.2453	PM: 0.2103
E	Fare gate aisle flow rate	32 ppm	
F	Passengers using farecard vendor	30 %	
G	Farecard vendor flow rate	2.5 transactions per min	
H	Farecard vendor peaking factor	1.1	

Scenario Analyzed	
Option	2: South Entrance
Entrance	South

Infrastructure Analysis									
		AM			PM			Critical	
		Alighting	Boarding	Total	Alighting	Boarding	Total		
K	Passengers, 3-hr peak	975	1611	2586	1563	993	2556		
L	Passengers, 30-min peak	239	395	634	329	209	538		**K** x **D**
M	Boarding passengers per minute		13.17			6.96			**L** / 30
	Alighting passengers per minute	20.41			28.05				**A** x 2**L** / 30
P	Platform Escalators Required	0.25	0.16	2	0.34	0.08	2	**2**	**M** / **B**
Q	Farecard Vendors Required		1.91	2		1.01	2	**2**	**M** x **F** x **G** x **H** + 10%
R	Fare Gate Aisles Required	0.64	0.41	2	0.88	0.22	2	**2**	**M** / **E**
S	ADA-Accessible Fare Gate Aisles Required	1	1	2	1	1	2	**2**	
T	Total Fare Gate Aisles Required			5			5	**5**	**R** + **S** + 10%

Bethesda Metrorail Station Infrastructure Analysis

Input			
A	Peaking factor for alighting passengers	1.28	
B	Escalator flow rate	83 ppm	
C	Stair flow rate	55 ppm	
D	30 min peak factor	AM: 0.2453	PM: 0.2103
E	Fare gate aisle flow rate	32 ppm	
F	Passengers using farecard vendor	30 %	
G	Farecard vendor flow rate	2.5 transactions per min	
H	Farecard vendor peaking factor	1.1	

Scenario Analyzed	
Option	3: Bi-County Transitway
Entrance	North

Infrastructure Analysis									
		AM			PM			Critical	
		Alighting	Boarding	Total	Alighting	Boarding	Total		
K	Passengers, 3-hr peak	1929	3453	5382	3334	1980	5314		
L	Passengers, 30-min peak	473	847	1320	701	416	1118		**K** x **D**
M	Boarding passengers per minute		28.23			13.88			**L** / 30
	Alighting passengers per minute	40.38			59.83				**A** x 2**L** / 30
P	Platform Escalators Required	0.49	0.34	2	0.72	0.17	2	**2**	**M** / **B**
Q	Farecard Vendors Required		4.10	5		2.02	3	**5**	**M** x **F** x **G** x **H** + 10%
R	Fare Gate Aisles Required	1.26	0.88	3	1.87	0.43	3	**3**	**M** / **E**
S	ADA-Accessible Fare Gate Aisles Required	1	1	2	1	1	2	**2**	
T	Total Fare Gate Aisles Required			6			6	**6**	**R** + **S** + 10%

Bethesda Metrorail Station Infrastructure Analysis

Input			
A	Peaking factor for alighting passengers	1.28	
B	Escalator flow rate	83 ppm	
C	Stair flow rate	55 ppm	
D	30 min peak factor	AM: 0.2453	PM: 0.2103
E	Fare gate aisle flow rate	32 ppm	
F	Passengers using farecard vendor	30 %	
G	Farecard vendor flow rate	2.5 transactions per min	
H	Farecard vendor peaking factor	1.1	

Scenario Analyzed	
Option	3: Bi-County Transitway
Entrance	South

Infrastructure Analysis									
		AM			PM			Critical	
		Alighting	Boarding	Total	Alighting	Boarding	Total		
K	Passengers, 3-hr peak	1214	2359	3573	2299	1234	3533		
L	Passengers, 30-min peak	298	579	876	483	260	743		**K** x **D**
M	Boarding passengers per minute		19.29			8.65			**L** / 30
	Alighting passengers per minute	25.41			41.26				**A** x 2**L** / 30
P	Platform Escalators Required	0.31	0.23	2	0.50	0.10	2	**2**	**M** / **B**
Q	Farecard Vendors Required		2.80	3		1.26	2	**3**	**M** x **F** x **G** x **H** + 10%
R	Fare Gate Aisles Required	0.79	0.60	2	1.29	0.27	3	**3**	**M** / **E**
S	ADA-Accessible Fare Gate Aisles Required	1	1	2	1	1	2	**2**	
T	Total Fare Gate Aisles Required			5			6	**6**	**R** + **S** + 10%

Appendix J: NFPA-130 Evaluation

Analysis period	AM	Option			
		Existing 2004	1 No-Build	2 S. Entr.	3 Bi-Co
Entraining Load	Peak 3-hr period	3298	5120	5223	5308
	Peak 1-hr period	1507	2339	2386	2425
	0.4568				
	Peak 15-min period	482	748	763	776
	1.28				
	Headway (min)	2.5	2.5	2.5	2.5
	Entraining Load for analysis	161	249	254	259
	Cars per train	6	8	8	8
	Car capacity	120	120	120	120
	Link load, peak direction	720	960	960	960
	Off-peak direction factor	0.4	0.4	0.4	0.4
	Link load, off-peak direction	288	384	384	384
	Total Occupant Load	**1169**	**1593**	**1598**	**1603**
	Time to Clear platform (min)	**15.3**	**20.9**	**7.0**	**7.0**
	Wait time at platform esc				
	North Portal	13.5	19.1	5.8	5.8
	South Portal			6.2	6.2
Split	***Trips to portal***				
0.7	North Portal	1169	1593	1119	1122
0.3	South Portal			480	481
	Faregate flow time				
	North Portal	2.4	3.3	2.3	2.3
	South Portal			1.3	1.3
	Wait time at faregates				
	North Portal	0.0	0.0	0.0	0.0
	South Portal			0.0	0.0
	Street esc flow time				
	North Portal	5.1	7.0	4.9	4.9
	South Portal			6.3	6.3
	Wait time at street esc				
	North Portal	0.0	0.0	0.0	0.0
	South Portal			0.0	0.0
	Total exit time				
	North Portal	18.6	24.2	10.3	10.3
	South Portal			10.4	10.4
	Evacuation Time (min)	**18.6**	**24.2**	**10.4**	**10.4**

WITHOUT SOUTH PORTAL

Platform to mezzanine capacity

	No.	width	pim	p/min
Stairs	0	0	1.59	0
Escalators*	1	48	1.59	76.32
Total				76.32
% Escalators:	100%			

Faregate capacity

North Portal

Faregates	8	8	50	400
Service gate	1	36	2.27	81.72
Total				481.72

Mezzanine to street capacity

North Portal

Escalators	3	144	1.59	228.96

Walking time for longest route

North Portal

	ft	ft/min	minutes
Platform	358	200	1.79
Escalator	13	50	0.26
Mezzanine	200	200	1
Escalator	100	50	2
Street	10	200	0.05
Total			5.1

WITH SOUTH PORTAL

Platform to mezzanine capacity

	No.	width	pim	p/min
Stairs	1	48	1.59	76.32
Escalators*	2	96	1.59	152.64
Total				228.96
% Escalators:	67%			

Faregate capacity

North Portal

Faregates	8	8	50	400
Service gate	1	36	2.27	81.72
Total				481.72

South Portal

Faregates	6	6	50	300
Service gate	1	36	2.27	81.72
Total				381.72

Mezzanine to street capacity

North Portal

Escalators	3	144	1.59	228.96

South Portal

Stairs**	1	48	1.59	76.32

Walking time for longest route

North Portal

	ft	ft/min	minutes
Platform	242	200	1.21
Escalator	13	50	0.26
Mezzanine	200	200	1
Escalator	100	50	2
Street	10	200	0.05
Total			4.52

South Portal

Platform	150	200	0.75
Escalator	13	50	0.26
Mezzanine	225	200	1.125
Stair	98	50	1.96
Street	10	200	0.05
Total			4.145

* One escalator is assumed to be out of service.

** Elevators are assumed to be out of service for evacuation purposes.

Analysis period	PM	Option			
		Existing 2004	1 No-Build	2 S. Entr.	3 Bi-Co
Entraining Load	Peak 3-hr period	2672	3149	3217	4285
	Peak 1-hr period	1238	1460	1491	1986
	0.4635				
	Peak 15-min period	396	467	477	636
	1.28				
	Headway (min)	2.5	2.5	2.5	2.5
	Entraining Load for analysis	132	156	159	212
	Cars per train	6	8	8	8
	Car capacity	120	120	120	120
	Link load, peak direction	720	960	960	960
	Off-peak direction factor	0.4	0.4	0.4	0.4
	Link load, off-peak direction	288	384	384	384
	Total Occupant Load	**1140**	**1500**	**1503**	**1556**
	Time to Clear platform (min)	**14.9**	**19.6**	**6.6**	**6.8**
	Wait time at platform esc				
	North Portal	13.1	17.9	5.4	5.6
	South Portal			5.8	6.0
Split	***Trips to portal***				
0.7	North Portal	1140	1500	1052	1089
0.3	South Portal			451	467
	Faregate flow time				
	North Portal	2.4	3.1	2.2	2.3
	South Portal			1.2	1.2
	Wait time at faregates				
	North Portal	0.0	0.0	0.0	0.0
	South Portal			0.0	0.0
	Street esc flow time				
	North Portal	5.0	6.5	4.6	4.8
	South Portal			5.9	6.1
	Wait time at street esc				
	North Portal	0.0	0.0	0.0	0.0
	South Portal			0.0	0.0
	Total exit time				
	North Portal	18.2	23.0	9.9	10.1
	South Portal			10.0	10.2
	Evacuation Time (min)	**18.2**	**23.0**	**10.0**	**10.2**

WITHOUT SOUTH PORTAL

Platform to mezzanine capacity

	No.	width	pim	p/min
Stairs	0	0	1.59	0
Escalators*	1	48	1.59	76.32
Total				76.32
% Escalators:	100%			

Faregate capacity

North Portal

Faregates	8	8	50	400
Service gate	1	36	2.27	81.72
Total				481.72

Mezzanine to street capacity

North Portal

Escalators	3	144	1.59	228.96

Walking time for longest route

North Portal

	ft	ft/min	minutes
Platform	358	200	1.79
Escalator	13	50	0.26
Mezzanine	200	200	1
Escalator	100	50	2
Street	10	200	0.05
Total			5.1

WITH SOUTH PORTAL

Platform to mezzanine capacity

	No.	width	pim	p/min
Stairs	1	48	1.59	76.32
Escalators*	2	96	1.59	152.64
Total				228.96
% Escalators:	67%			

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Service gate	1	36	2.27	81.72
Total				481.72

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Faregates	6	6	50	300
Service gate	1	36	2.27	81.72
Total				381.72

Mezzanine to street capacity

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Escalators	3	144	1.59	228.96

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	ft	ft/min	minutes
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Mezzanine	200	200	1
Escalator	100	50	2
Street	10	200	0.05
Total			4.52

South Portal

Platform	150	200	0.75
Escalator	13	50	0.26
Mezzanine	225	200	1.125
Stair	98	50	1.96
Street	10	200	0.05
Total			4.145

* One escalator is assumed to be out of service.

** Elevators are assumed to be out of service for evacuation purposes.